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FILE NO. SM-CTV-O-046

COLOR TELEVISION
SERVICE MANUAL

MODEL NO.: AT3208S
CHASSIS NO.: CH-10C3

Please read this manual carefully before service

PRINTED IN CHINA.MAY.2003 ©

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SAFETY INSTRUCTIONS

WARNING: BEFORE SERVICING THIS CHASSIS, READ THE “X-RAY RADIATION PRECAUTION”, “SAFETY PRECAUTION” AND “PRODUCT SAFETY NOTICE” INSTRUCTIONS BELOW.

X-RAY RADIATION PRECAUTION

1. The EHT must be checked every time the TV is serviced to ensure that the CRT does not emit X-ray radiation as result of excessive EHT voltage. The nominal EHT for this TV is 28.8±0.8KV at zero beam current (minimum brightness) operating at AC 120V. The maximum EHT voltage permissible in any operating circumstances must not exceed 31KV. When checking the EHT, use the High Voltage Check procedure in this manual using an accurate EHT voltmeter.
2. The only source of X-RAY in this TV is the CRT. To prevent X-ray radiation, the replacement CRT must be identical to the original fitted as specified in the parts list.
3. Some components used in this TV have safety related characteristics preventing the CRT from emitting X-ray radiation. For continued safety, replacement component should be made after referring the PRODUCT SAFETY NOTICE below.

SAFETY PRECAUTION

1. The TV has a nominal working EHT voltage of 28.8KV. Extreme caution should be exercised when working on the TV with the back removed.

1) Do not attempt to service this TV if you are not conversant with the precautions and procedures for working on high voltage equipment.
2) When handling or working on the CRT, always discharge the anode to the TV chassis before removing the anode cap in case of electric shock.
3) The CRT, if broken, will violently expel glass fragments. Use shatterproof goggles and take extreme care while handling.
4) Do not hold the CRT by the neck as this is a very dangerous practice.

2. It is essential that to maintain the safety of the customer all power cord forms be replaced exactly as supplied from factory.
3. Voltage exists between the hot and cold ground when the TV is in operation. Install a suitable isolating transformer of beyond rated overall power when servicing or connecting any test equipment for the sake of safety.
4. Replace blown fuses within the TV with the fuse specified in the parts list.
5. When replacing wires or components to terminals or tags, wind the leads around the terminal before soldering. When replacing safety components identified by the international hazard symbols in the circuit diagram and parts list, it must be the company-approved type and must be mounted as the original.
6. Keep wires away from high temperature components.

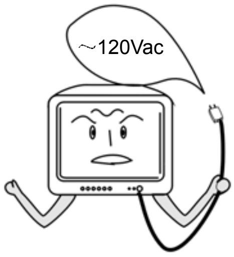
SAFETY INSTRUCTIONS(continued)

PRODUCT SAFETY NOTICE

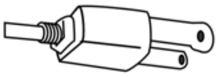
Many electrical and mechanical components in this chassis have special safety-related characteristics. These characteristics are often passed unnoticed by a visual inspection and the X-ray radiation protection afforded by them can not necessarily be obtained by using replacements rated at higher voltages or wattage, etc. Components which have these special safety characteristics in this manual and its supplements are identified by the international hazard symbols in the circuit diagram and parts list. Before replacing any of these components read the parts list in this manual carefully. Substitute replacement components which do not have the same safety characteristics as specified in the parts list may create X-ray radiation.

PRECAUTIONS

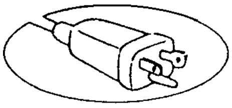
Power Sources-The TV set should be operated only from the type of power source indicated on the TV set or as indicated in the Service Manual. If you are not sure of the type of power supply in your home, consult your sales person or your local power company. For TV sets designed to operate from battery power,or other Sources, refer to the operating instructions.



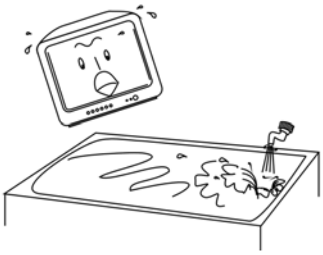
Grounding or Polarization-Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet,consult an electrician for replacement of the obsolete outlet.



Alternate Warnings-A three wire grounding type plug-a plug having a third (grounding) pin. This plug will only fit into grounding type power outlet.



Water and Moisture Warnings-Do not use the TV set near water-for example,near a bath tub,wash bowl,kitchen sink, or laundry tub;in a wet basement;or near a swimming pool; and the like.The TV set shall not be exposed to dripping or splashing and no objects filled with liquids,such as vases,shall be placed on the TV set.



Ventilation-Slots and openings in the cabinet are provided for ventilation and to ensure reliable operation of the TV set and to protect it from overheating, and these openings must not be blocked or covered. The openings should never be blocked by placing the TV set on a bed, sofa, rug,or other similar surface. This TV set should not be placed in a built-in installation such as a bookcase or rack unless proper ventilation is provided or the manufacturer′s instructions have been adhered to.

SPECIFICATIONS

Model Number	AT3208S
Television system	NTSC-M
Channel coverage	VHF 2～13/UHF 14～69/CABLE TV: MID BAND (A-8～A-1,A～I) SUPER BAND (J～W) HYPER BAND (AA～ZZ, AAA, BBB) ULTRA BAND (65～94, 100～125)
Channels preset	181
Antenna input	75Ω(unbalanced)
Picture tube Effective screen dimensions(Approx.)	640×480mm 25.2×18.9in
Max. audio output	5W+5W
Power source	～120Vac 60Hz
Weight (Approx.)	57kg(126 lbs.)
Dimensions (W/H/D) (Approx.)	854×684×560mm 33.6×26.9×22.1in
Packing Dimensions (W/H/D) (Approx.)	980×777×655mm 38.6×30.6×25.8in
Rated power consumption	150W

Designs and specifications are subject to change without notice.

KEY ICS AND ASSEMBLIES

Table 1 Key ICs and Assemblies

Serial No.	Position No.	Type	Function Description
1	N301	OM8839PS	Small signal processor
2	N401	TDA8350-N6	Vertical output circuit
3	N601	TDA7057AQ	Sound power amplifier
4	ND01	HEF4053BP	Analog switch circuit
5	N001	LC86F3248AU-DIP	Microcontroller
6	N002	AT24C08-10P	EEPROM
7	NQ821	STR-6626	Power thick-film circuit
8	NY01	TDA6108JF	Video amplifier
9	NK02	TC90A13N	Digital comb filter
10	NK03	MM1031X5	Luminance signal amplifier
11	N606M	MSP3440	Audio demodulating and NICAM decoding circuit
12	NQ102	TDA9808T	IF signal processor
13	DS01	TA1219N	TV/Video switch circuit
14	DS02	TA78L009AP	Tri-terminal regulator
15	N103	TA78L009AP	Tri-terminal regulator
16	N402	LM317T	Tri-terminal regulator
17	A101	TDQ-6F2-M	Tuner

SYSTEM BLOCK DIAGRAMS (continued)

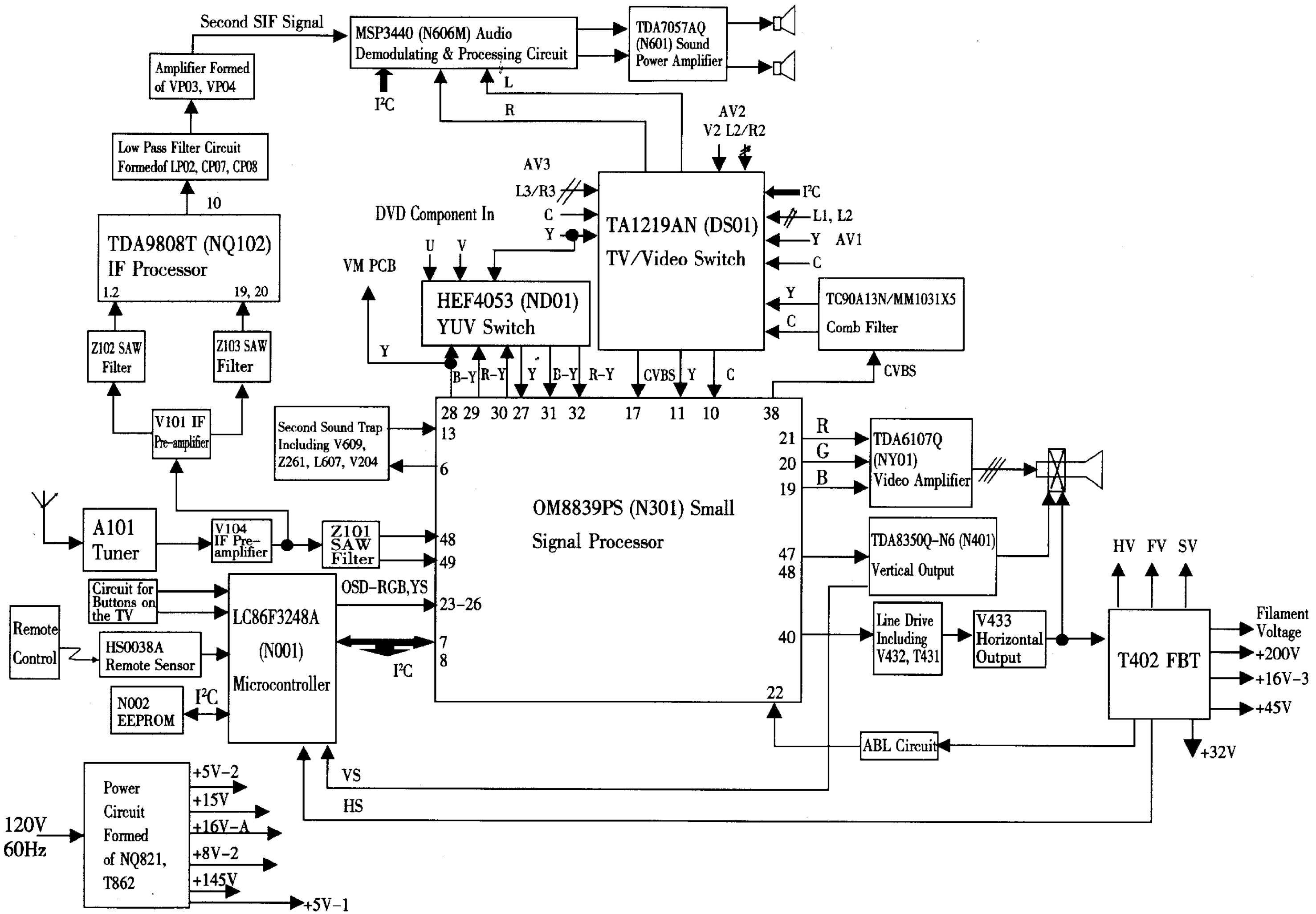

Second SIF Signal
MSP3440 (N606M) Audio Demodulating & Processing Circuit
TDA7057AQ (N601) Sound Power Amplifier
Amplifier Formed of VP03, VP04
I²C
L
R
AV2
V2 L2/R2
Low Pass Filter Circuit Formedof LP02, CP07, CP08
AV3
L3/R3
10
DVD Component In
C
Y
TA1219AN (DS01) TV/Video Switch
I²C
L1, L2
Y AV1
C
TDA9808T (NQ102) IF Processor
1.2
19, 20
VM PCB
U V
HEF4053 (ND01) YUV Switch
Y
C
TC90A13N/MM1031X5 Comb Filter
Z102 SAW Filter
Z103 SAW Filter
Y
B-Y R-Y Y B-Y R-Y
CVBS Y C
CVBS
28 29 30 27 31 32 17 11 10 38
V101 IF Pre-amplifier
Second Sound Trap Including V609, Z261, L607, V204
13
6
21
20
19
R
G
B
TDA6107Q (NY01) Video Amplifier
OM8839PS (N301) Small Signal Processor
A101 Tuner
V104 IF Pre-amplifier
Z101 SAW Filter
48
49
47
48
TDA8350Q-N6 (N401) Vertical Output
HV FV SV
Circuit for Buttons on the TV
OSD-RGB,YS
23-26
Remote Control
HS0038A Remote Sensor
LC86F3248A (N001) Microcontroller
7
8
I²C
40
Line Drive Including V432, T431
V433 Horizontal Output
T402 FBT
Filament Voltage
+200V
+16V-3
+45V
N002 EEPROM
I²C
22
ABL Circuit
+32V
VS
HS
Power Circuit Formed of NQ821, T862
120V
60Hz
+5V-2
+15V
+16V-A
+8V-2
+145V
+5V-1

Fig.1 Structure Block Diagram for CH-10C3 Chassis

SYSTEM BLOCK DIAGRAMS (continued)

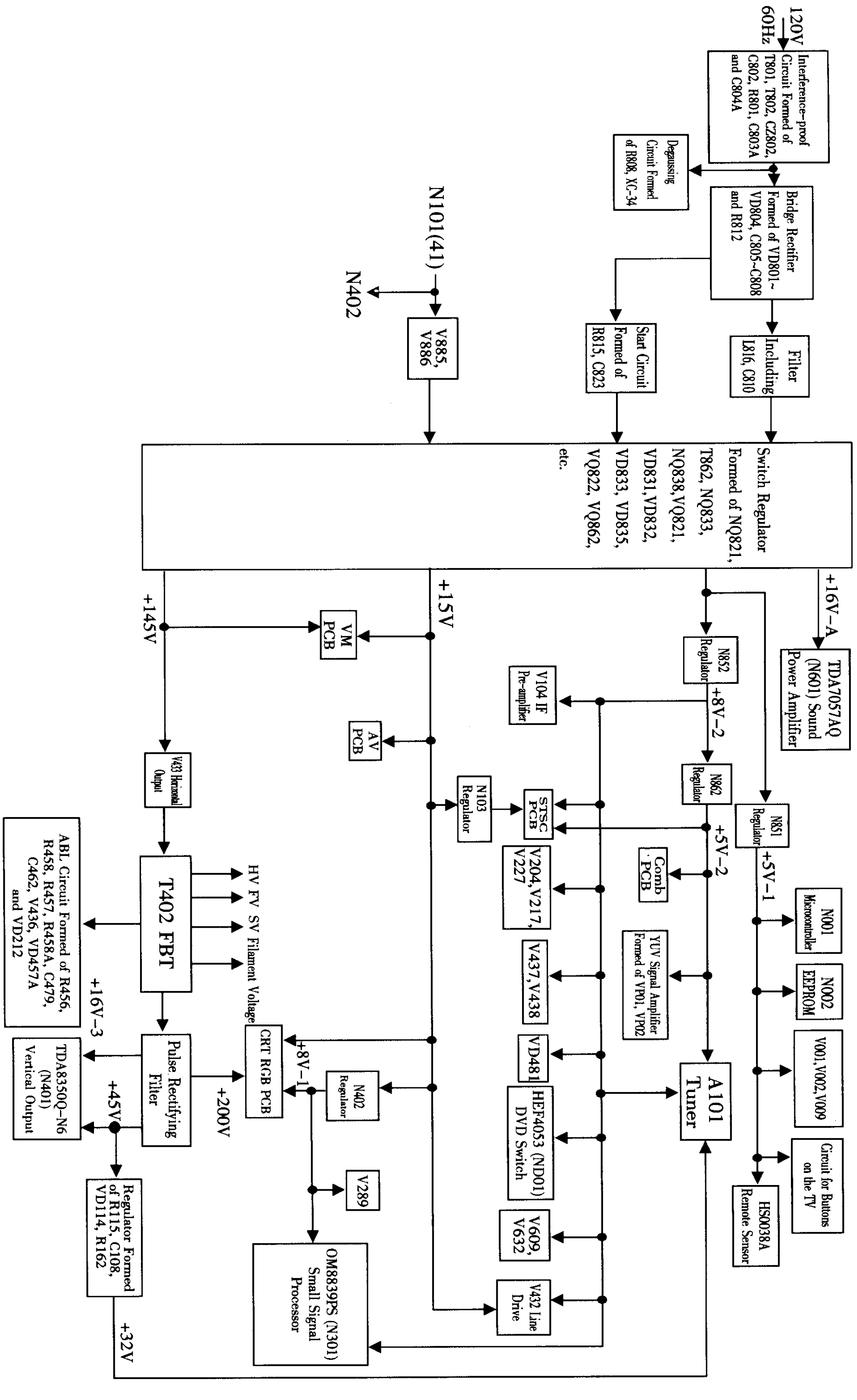

120V
60Hz
Interference-proof Circuit Formed of T801, T802, CZ802, C802, R801, C803A and C804A
Degaussing Circuit Formed of R808, XC-34
Bridge Rectifier Formed of VD801~VD804, C805~C808 and R812
Filter Including L816, C810
Start Circuit Formed of R815, C823
N101(41)
N402
V885, V886
Switch Regulator Formed of NQ821, T862, NQ833, NQ838,VQ821, VD831,VD832, VD833, VD835, VQ822, VQ862, etc.
+16V-A
TDA7057AQ (N601) Sound Power Amplifier
N852 Regulator
+8V-2
V104 IF Pre-amplifier
N862 Regulator
N851 Regulator
+5V-2
+5V-1
STSC PCB
N103 Regulator
Comb PCB
V204,V217, V227
YUV Signal Amplifier Formed of VP01, VP02
N001 Microcontroller
N002 EEPROM
V001,V002,V009
Circuit for Buttons on the TV
HS0038A Remote Sensor
V437,V438
VD481
A101 Tuner
HEF4053 (ND01) DVD Switch
V609, V632
V432 Line Drive
+15V
VM PCB
AV PCB
+145V
V433 Horizontal Output
T402 FBT
HV FV SV Filament Voltage
CRT RGB PCB
+8V-1
N402 Regulator
V289
OM8839PS (N301) Small Signal Processor
+200V
Pulse Rectifying Filter
ABL Circuit Formed of R456, R458, R457, R458A, C479, C462, V436, VD4557A and VD212
+16V-3
+45V
TDA8350Q-N6 (N401) Vertical Output
Regulator Formed of R115, C108, VD114, R162
+32V

Fig.2 Block Diagram for CH-10C3 Supply Voltage System

SYSTEM BLOCK DIAGRAMS (continued)

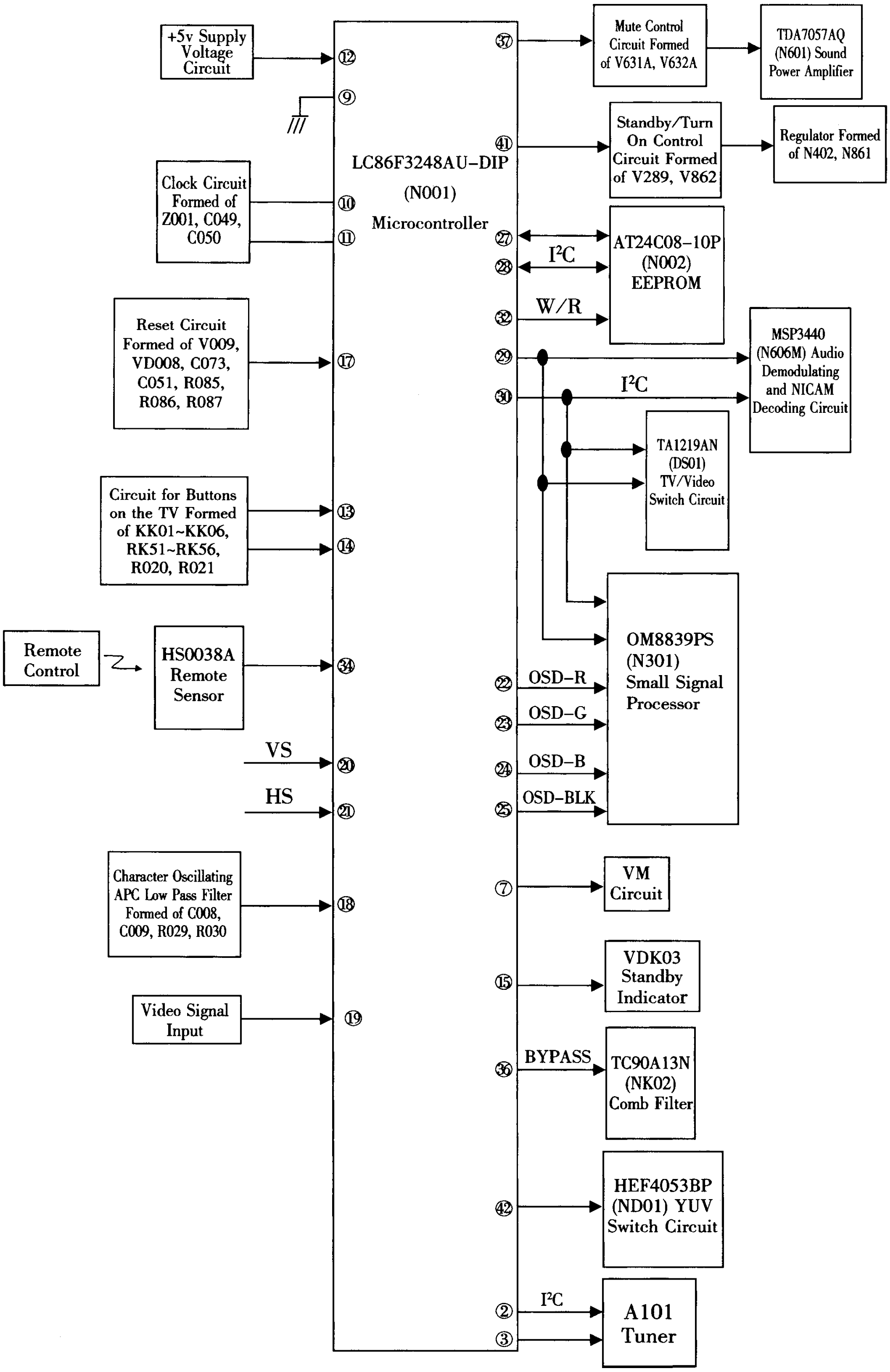

+5v Supply Voltage Circuit
⑫
⑨
Clock Circuit Formed of Z001, C049, C050
⑩
⑪
Reset Circuit Formed of V009, VD008, C073, C051, R085, R086, R087
⑰
Circuit for Buttons on the TV Formed of KK01~KK06, RK51~RK56, R020, R021
⑬
⑭
Remote Control
HS0038A Remote Sensor
㉞
VS
⑳
HS
㉑
Character Oscillating APC Low Pass Filter Formed of C008, C009, R029, R030
⑱
Video Signal Input
⑲
LC86F3248AU-DIP (N001) Microcontroller
㊲
Mute Control Circuit Formed of V631A, V632A
TDA7057AQ (N601) Sound Power Amplifier
㊶
Standby/Turn On Control Circuit Formed of V289, V862
Regulator Formed of N402, N861
㉗
㉘
I²C
AT24C08-10P (N002) EEPROM
㉜
W/R
㉙
㉚
I²C
MSP3440 (N606M) Audio Demodulating and NICAM Decoding Circuit
TA1219AN (DS01) TV/Video Switch Circuit
OM8839PS (N301) Small Signal Processor
㉒ OSD-R
㉓ OSD-G
㉔ OSD-B
㉕ OSD-BLK
⑦
VM Circuit
⑮
VDK03 Standby Indicator
㊱ BYPASS
TC90A13N (NK02) Comb Filter
㊷
HEF4053BP (ND01) YUV Switch Circuit
I²C
②
③
A101 Tuner

Fig.3 Block Diagram for CH-10C3's Remote Control Structure

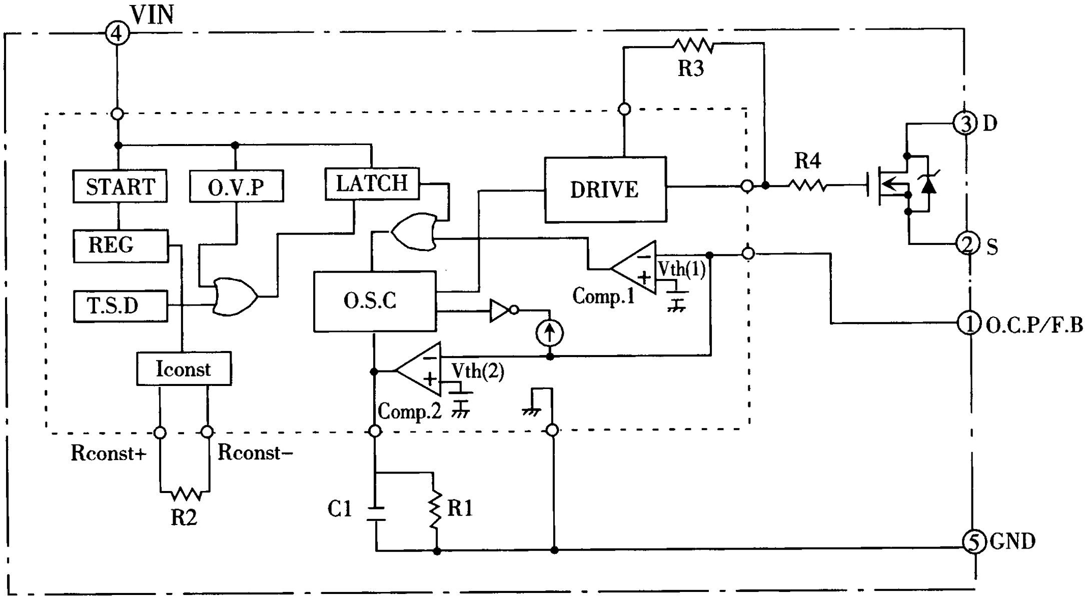
IC DATA AND WAVEFORMS OF KEY POINTS

STR-F6626 Power Thick-film Circuit

1. Features

STR-F6626 is one of Sanken STR-F66XX switch power thick-film hybrid Ics, which comprises a start circuit, oscillator, latch, driver, overcurrent protector, overvoltage protector and overheat protector.

2. System Block Diagram



3.Refer to Table 2 about Functions and Service Data of STR-F6626's Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

LC86F3248A (D701) 8-Bit Single Chip Microcontroller

1. Overview

The LC863264/56/48/40A are 8-bit single chip microcontrollers with the following on-chip functional blocks:

-CPU:Operable at a minimum bus cycle time of 0.424μs

-On-chip ROM capacity

Program ROM:64K/56K/48K/40K bytes

CGROM:16K bytes

-On-chip ROM capacity: 640 bytes

-OSD RAM: 352×9 bits

-Closed-Caption TV controller and the on-screen display controller

-Closed-Caption data slicer

-Four channels×8-bit AD Converter

-Three channels×7-bit PWM

-Two16-bit timer/counters, 14-bit base timer

-8-bit synchronous serial interface circuit

-IIC-bus compliant serial interface circuit (Multi-master type)

-ROM correction function

-16-source 10-vectored interrupt system

-Integrated system clock generator and display clock generator

Only one X′tal oscillator (32.768kHz) for PLL reference is used for both generators

TV control and the Closed Caption function

All of the above functions are fabricated on a single chip

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

LC86F3248A (continued)

2. System Block Diagram

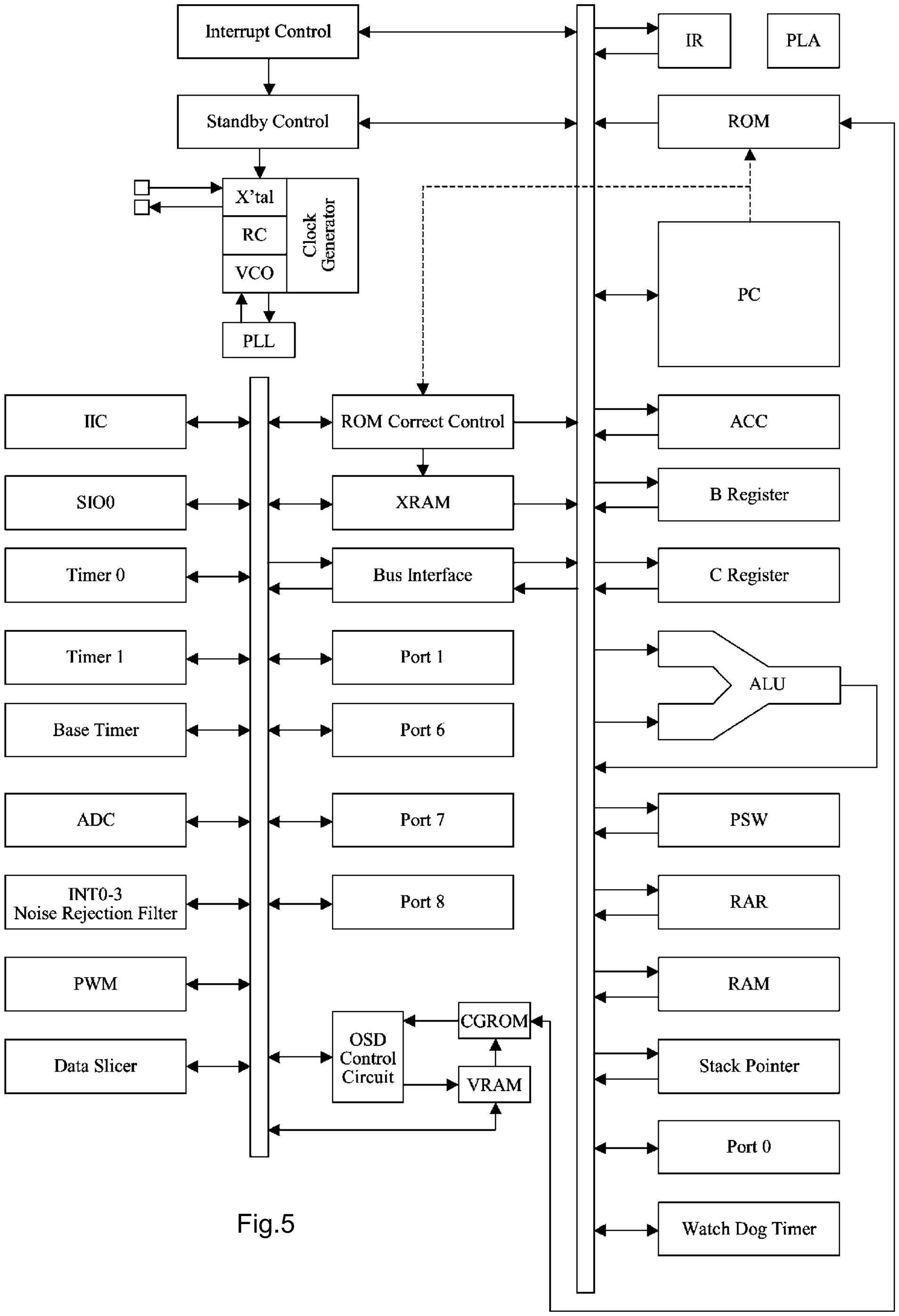


Fig.5

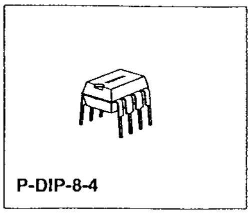
3.Refer to Table 3 about Functions and Service Data of LC86F3248'S Each Pin.

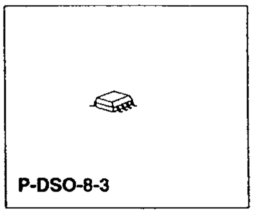
IC DATA AND WAVEFORMS OF KEY POINTS (continued)

AT24C08 EEPROM

1. Features

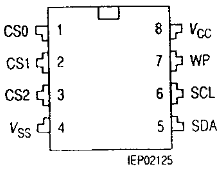
- Data EEPROM internally organized as 1024/2048 bytes and 64/128 pages×16 bytes
- Page protection mode, flexible page-by-page hardware write protection
  - -Additional protection EEPROM of 64/128 bits, 1 bit per data page
  - -Protection setting for each data page by writing its protection bit
  - -Protection management without switching WP pin
- Low power CMOS
- Vcc=2.7 to 5.5V operation
- Two wire serial interface bus, I^{2}C-Bus compatible
- Filtered inputs for noise suppression with Schmitt trigger
- Clock frequency up to 400 kHz
- High programming flexibility
  - -Internal programming voltage
  - -Self timed programming cycle including erase
  - -Byte-write and page-write programming, between 1 and 16 bytes
  - -Typical programming time 6 ms(<10ms) for up to 16 bytes
- High reliability
  - -Endurance 10^6 cycles1)
  - -Data retention 40 years1)
  - -ESD protection 4000 V on all pins
- 8 pin DIP/DSO packages
- Available for extended temperature ranges
  - -Industrial: -40℃ to +85℃
  - -Automotive: -40℃ to +125℃



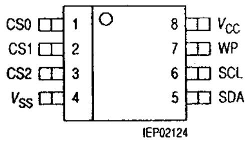


2. Pin Configuration

P-DIP-8-4



P-DSO-8-3



3. Block Diagram

4. Refer to Table 4 about Functions and Service Data of AT24C08's Pins.

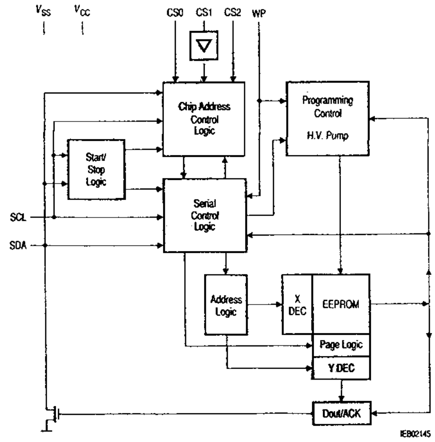


Fig. 6

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

OM8839PS/TDA884X

I^{2}C-bus Controlled PAL/NTSC/SECAM TV Processors

1. Features

The following features are available in all IC’s:

- Multi-standard vision IF circuit with PLL demodulator
- Alignment-free multi-standard FM sound demodu-lator (4.5 MHz to 6.5 MHz)
- Audio switch
- Flexible source selection with CVBS switch and Y(CVBS)/C input so that a comb filter can be applied
- Integrated chrominance trap circuit
- Integrated luminance delay line
- Asymmetrical peaking in the luminance channel with a (defeatable) noise coring function
- Black stretching of non-standard CVBS or luminance signals
- Integrated chroma band-pass filter with switchable centre frequency
- Dynamic skin tone control circuit
- Blue stretch circuit which offsets colours near white towards blue
- RGB control circuit with “Continuous Cathode Calibration” and white point adjustment
- Linear RGB inputs and fast blanking
- Possibility to insert a“blue back” option when no video signal is available
- Horizontal synchronization with two control loops and alignment-free horizontal oscillator
- Vertical count-down circuit
- Vertical driver optimised for DC-coupled vertical output stages
- I^{2}C-bus control of various functions
- Low dissipation (850 mW)

2. General Description

The various versions of the TDA 884X/5X series are I^{2}C-bus controlled single chip TV processors which are intended to be applied in PAL, NTSC, PAL/NTSC and multi-standard television receivers.

These IC’s are nearly pin compatible with the TDA 837× TV processors but have a higher degree of integration because the delay line (TDA4665 function) and the SECAM decoder have been intagrated.In addition to these functions some additional features have been added like “Continuous Cathode Calibration” (2-point black current loop which results in an accurate biasing of the 3 guns), adjustable luminance delay time, blue stretching and dynamic skin tone (“flesh”) control.

Functionally the IC series is split up in 3 categories, viz

- Versions intended to be used in economy TV receivers with all basic functions (envelope: S-DIP 56 and QFP64)
- Versions with additional features like E-W geometry control, H-V zoom function and YUV interface which are intended for TV receivers with 110° picture tubes (envelope: S-DIP 56)
- Versions which have in addition a second RGB input with saturation control and a second CVBS output (envelope:QFP 64)

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

OM8839PS/TDA884X (continued)

3. Block Diagram

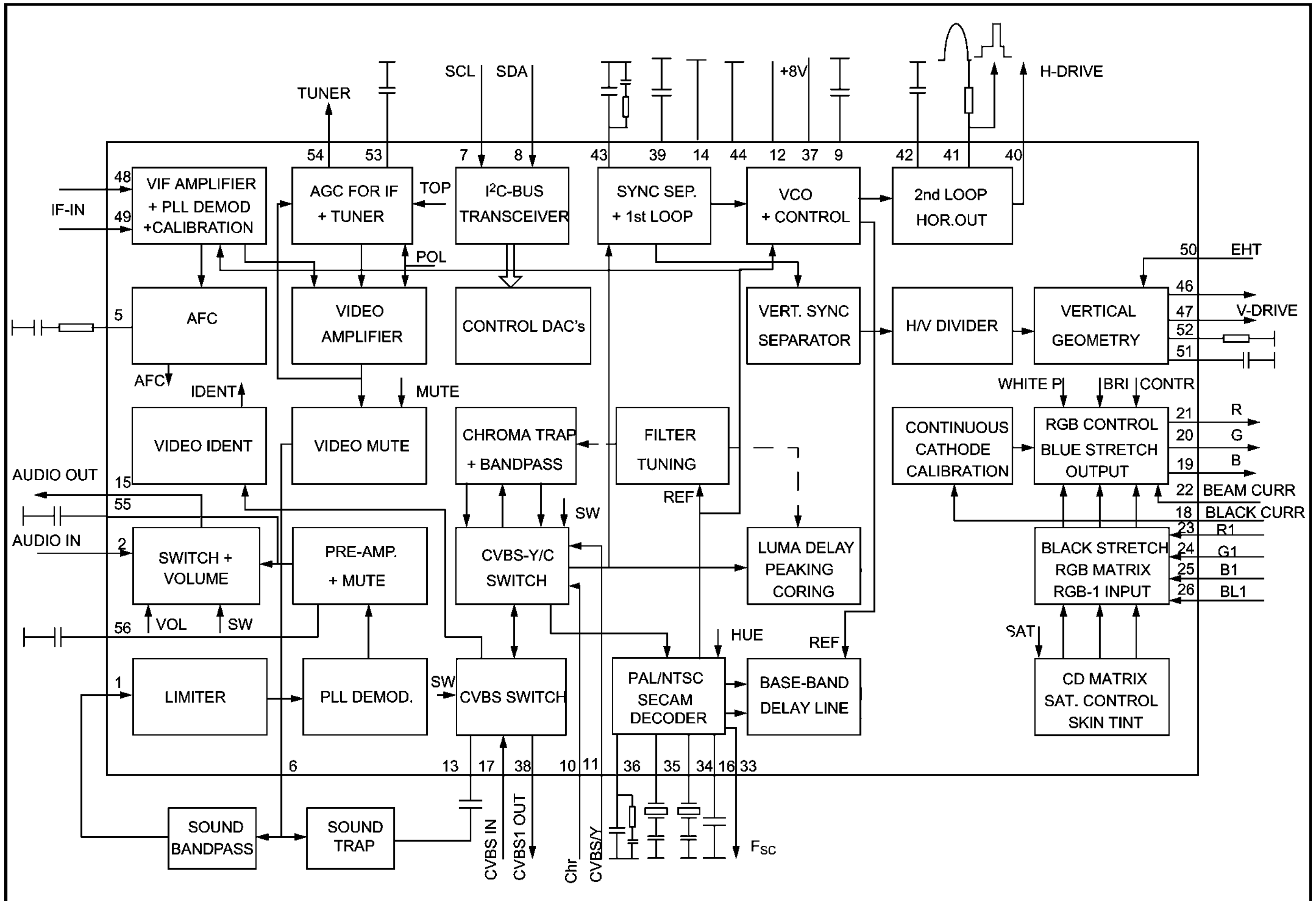


Fig.7 Block Diagram OM8839PS (S-DIP 56 Envelope)

4. Refer to Table 5 about Functions and Service Data of OM8839PS′ s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TDA8350Q

DC-coupled Vertical Deflection and East-West Output Circuit

1. Features

- Few extemal components
- Highly efficient fully DC-coupled vertical output bridge circuit
- Vertical flyback switch
- Guard circuit
- Protection against:
  - -short-circuit of the output pins
  - -short-circuit of the output pins to Vp
- High EMC immunity due to common mode inputs
- Temperature (thermal) protection
- East-West output stage with one single conversion resistor.

2. General Description

The TDA8350Q is a power circuit for use in 90° and 110° colour deflection systems for field frequencies of 50 to 120 Hz. The circuit provides a DC driven vertical deflection output circuit, operating as a highly efficient class G system and an East-West driver for sinking the diode modulator current.

3. Block Diagram

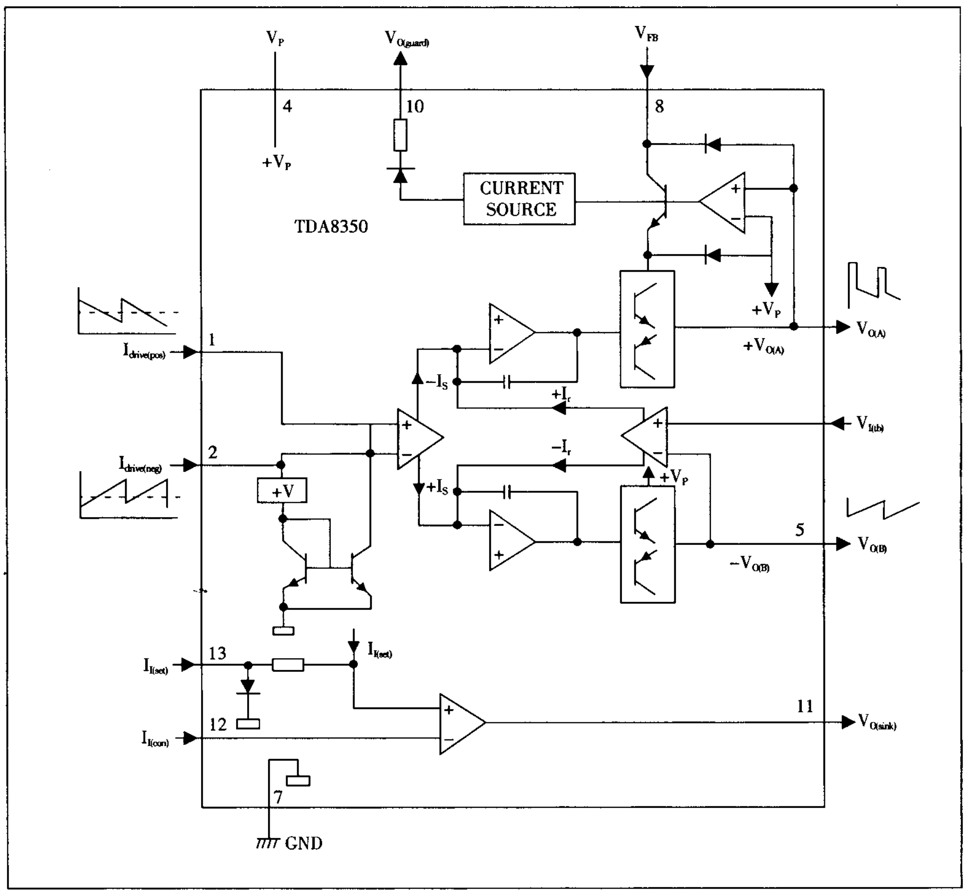


Fig.8

4. Refer to Table 6 about Functions and Service Data of TDA8350Q′ s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TDA7057AQ

2×8W Stereo BTL Audio Output Amplifier with DC Volume Control

1. Features

- DC volume control
- Few external components
- Mute mode
- Thermal protection
- Short-circuit proof
- No switch-on and switch-off clicks
- Good overall stability
- Low power consumption
- Low HF radiation
- ESD protected on all pins.

2. General Description

The TDA7057AQ is a stereo BTL output amplifier with DC volume control. The device is designed for use in TVs and monitiors, but is also suitable for battery-fed portable recorders and radios.

Missing Current Limiter (MCL)

A MCL protection circuit is built-in. The MCL circuit is activated when the difference in current between the output terminal of each amplifier exceeds 100 mA (typical 300 mA). This level of 100 mA allows for single-ended headphone applications.

3. Block Diagram

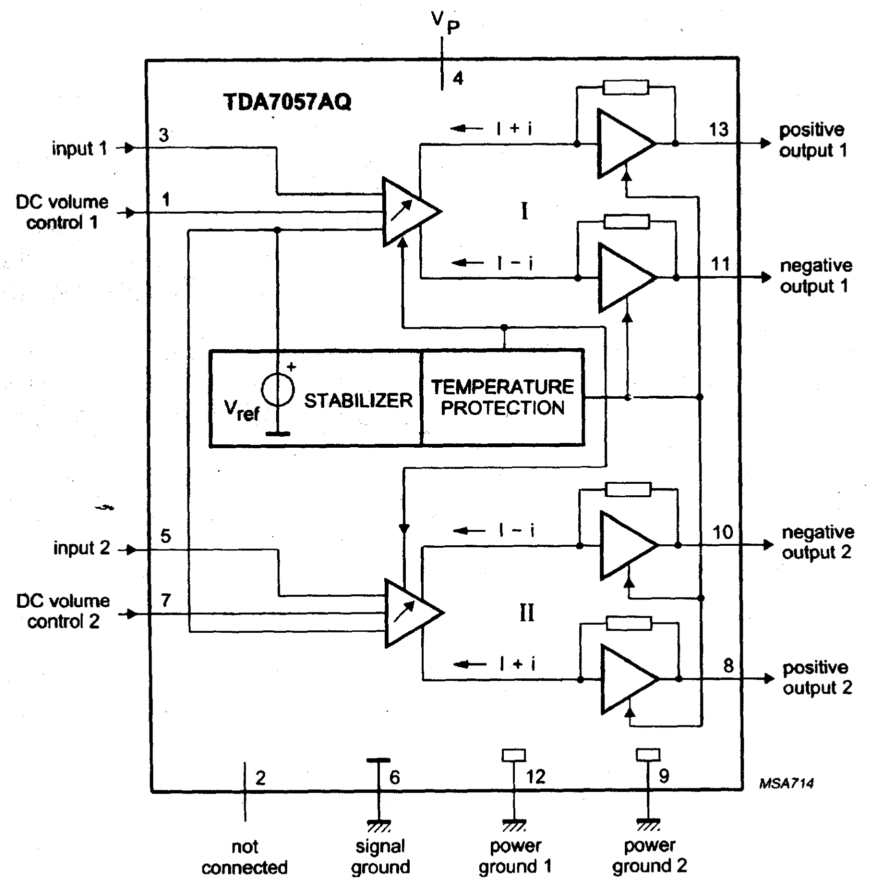


Fig.9

4.Refer to Table 7 about Functions and Service Data of TDA7057AQ′s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TDA6108JF

Triple Video Output Amplifier

1. Features

- Typical bandwidth of 9.0 MHz for an output signal of 60 V (peak-to-peak value)
- High slew rate of 1850 V/μS
- No external components required
- Very simple application
- Single supply voltage of 200 V
- Internal reference voltage of 2.5 V
- Fixed gain of 51
- Black-Current Stabilization (BCS) circuit
- Thermal protection.

2. General Description

The TDA6108JF includes three video output amplifiers in one plastic DIL-bent-SIL 9-pin medium power (DBS9MPF) package (SOT 111-1), using high-voltage DMOS technology, and is intended to drive the three cathodes of a colour CRT directly. To obtain maximum performance, the amplifier should be used with black-current control.

3. Ordering Information

Type Number	Package		
	Name	Description	Version
TDA6108JF	DBS9MPE	Plastic DIL-bent-SIL medium power package with fin;9 leads	SOT111-1

4. Block Diagram

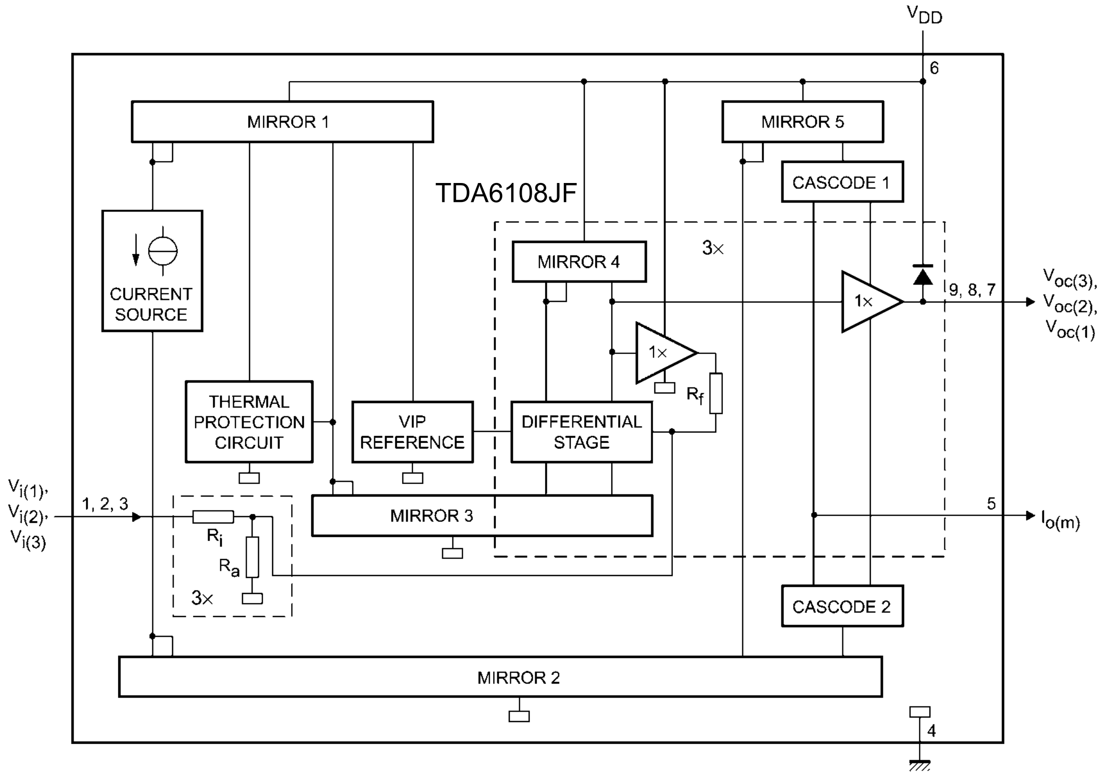


Fig. 10

4. Refer to Table 8 about Functions and Service Data of TDA6108JF′s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

HEF4053
Triple 2-channel Analog Multiplexer/Demultiplexer

1. Description

The HEF4053 is a triple 2-channel analog multiplexer/demultiplexer with a common enable input ($\overline{E}$). Each multiplexer/demultiplexer has two independent inputs/outputs (Y_0 and Y_1), a common input/output (Z), and select inputs (Sn). Each also contains two-bidirectional analog switches, each with one side connected to an independent input/output (Y_0 and Y_1) and the other side connected to a common input/output (Z).

With ($\overline{E}$) LOW, one of the two switches is selected (low impedance ON-state) by Sn. With $\overline{E}$ HIGH, all switches are in the high impedance OFF-state, independent of S_A to S_C.

V_{DD} and V_{SS} are the supply voltage connections for the digital control inputs (S_A to S_C and $\overline{E}$).

The V_{DD} to V_{SS} range is 3 to 15V.The analog inputs/outputs (Y_0,Y_1 and Z) can swing between V_{DD} as a positive limit and V_{EE} as a negative limit. V_{DD}-V_{EE} may not exceed 15 V.

For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to V_{SS} (typically ground).

2. Block Diagrams

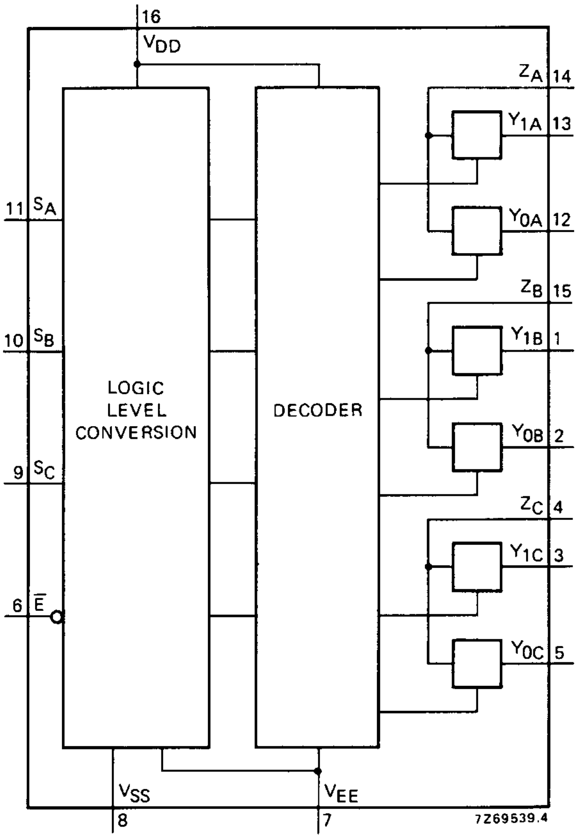
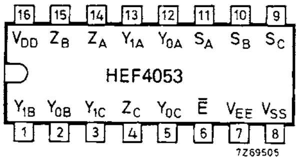


Fig. 11

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

HEF4053 (continued)


16 15 14 13 12 11 10 9
V_{DD} Z_B Z_A Y_{1A} Y_{0A} S_A S_B S_C
HEF4053
Y_{1B} Y_{0B} Y_{1C} Z_C Y_{0C} $\bar{E}$ V_{EE} V_{SS}
1 2 3 4 5 6 7 8
7Z69505

Pinning Diagram

Pinning

Y_{0A} to Y_{0C}	Independent inputs/outputs
Y_{1A} to Y_{1C}	Independent inputs/outputs
S_A to S_c	Select inputs
E	Enable input (active LOW)
Z_A to Z_C	Common inputs/outputs

3. Function Table

Inputs		**Channel**
E	**Sn**	**On**
L	L	Y_0n-Zn
L	H	Y_1n-Zn
H	X	none

Notes

H=HIGH state (the more positive voltage)

L=LOW state (the less positive voltage)

X=STATE is immaterial

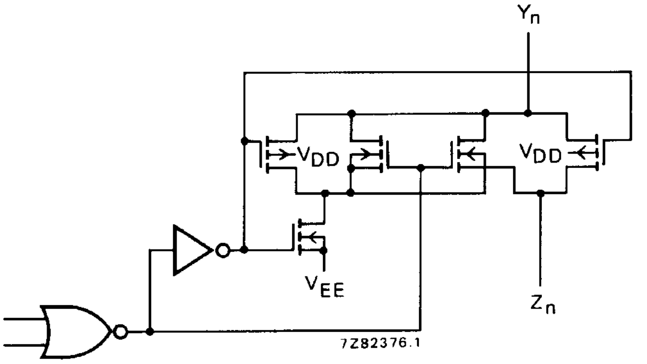


Fig. 12 Schematic Diagram (One Switch)

Ratings

Limiting values in accordance with the Absolute Maximum System(IEC 134)

Supply voltage (with reference to V_{DD}) V_{EE} -18 to + 0,5 V

Note

To avoid drawing V_{DD} current out of terminal Z, when switch current flows into terminals Y, the voltage drop across the bidirecctional switch must not exceed 0,4 V. If the switch current flows into terminal Z, no V_{DD} current will flow out of terminals Y, in this case there is no limit for the voltage drop across the switch, but the voltages at Y and Z may not exceed V_{DD} or V_{EE}

4. Refer to Table 9 about Functions and Data of IC′s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

MSP34×0G

Multistandard Sound Processor Family

Release Note: Revision bars indicate significant changes to the previous edition. The hardware and software description in this document is valid for the MSP 34×0G version B5 and following versions.

1. Introduction

The MSP34×0G family of single-chip Multistandard Sound Processors covers the sound processing of all analog TV-Standards worldwide, as well as the NICAM digital sound standards. The full TV sound processing, starting with analog sound IF signal-in, down to processed analog AF-out, is performed on a single chip. Figure 13 shows a simplified functional block diagram of the MSP 34×0G.

This new generation of TV sound processing ICs now includes versions for processing the multichannel television sound (MTS) signal conforming to the standard recommended by the Broadcast Television Systems Committee (BTSC). The DBX noise reduction, or alternatively MICRONAS Noise Reduction (MNR) is performed alignment free

Other processed standards are the Japanese FM-FM multiplex standard (EIA-J) and the FM Stereo Radio standard.

Current ICs have to perform adjustment procedures in order to achieve good stereo separation for BTSC and EIA-J.

The MSP 34×0G has optimum stereo performance without any adjustments.

All MSP 34×0G versions are pin and software downward-compatible to the MSP 34×0D. The MSP34×0G further simplifies controlling software. Standard selection requires a single I^2C transmission only.

The MSP 34×0G has built-in automatic Functions: The IC is able to detect the actual sound standard automatically (Automatic Standard Detection). Furthermore, pilot levels and identification signals can be evaluated internally with subsequent switching between mono/stereo/bilingual; no I^2C interaction is necessary (Automatic Sound Selection).

The ICs are produced in submicron CMOS technology.

The MSP34×0G is available in the following packages: PLCC68, PSDIP64, PSDIP52 PQFP80 and PLQFP64.

2. Block Diagram

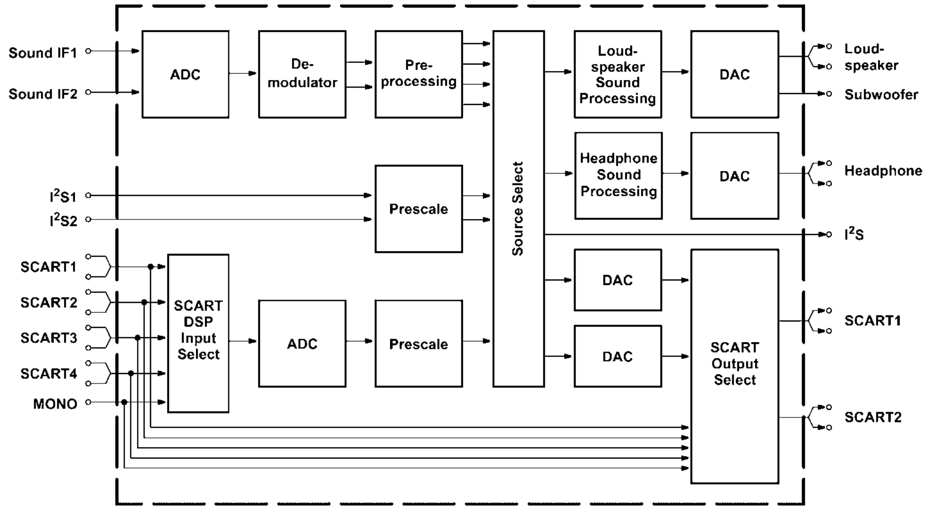


Fig. 13 Simplified Functional Block Diagram of the MSP 34×0G

3. Refer to Table 10 about Functions and Service Data of MSP 34X0G′ s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TDA9808T

Single Standard VIF-PLL with QSS-IF and FM-PLL Demodulator

1.Features

- 5V supply voltage (9V supply voltage for TDA9808(DIP20) only)
- Applicable for IFs (Intermediate Frequencies) of 38.9MHz, 45.75MHz and 58.75 MHz
- Gain controlled wide band Video IF (VIF)-amplifier (AC-coupled)
- True synchronous demodulation with active carrier regeneration (very linear demodulation, good intermodulation figures, reduced harmonics, excellent pulse response)
- Robustness for over-modulation better than 105% due to Phase Locked Loop (PLL)-bandwidth control at negative modulated standards
- VIF Automatic Gain Control (AGC) detector for gain control, operating as peak sync detector
- Tuner AGC with adjustable TakeOver Point (TOP)
- Automatic Frequency Control (AFC) detector without extra reference circuit
- AC-coupled limiter amplifier for sound intercarrier signal
- Alignment-free FM-PLL demodulator with high linearity
- Sound IF (SIF) input for single reference Quasi Split Sound (QSS) mode (PLL controlled); SIF AGC detector for gain controlled SIF amplifier; single reference QSS mixer for high performance
- Electrostatic Discharge (ESD) protection for all pins.

2.General Description

The TDA9808 is an integrated circuit for single standard (negative modulated) vision IF signal processing and FM demodulation, with single reference QSS-IF in TV and VTR sets.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TDA9808T (continued)

2. Block Diagram

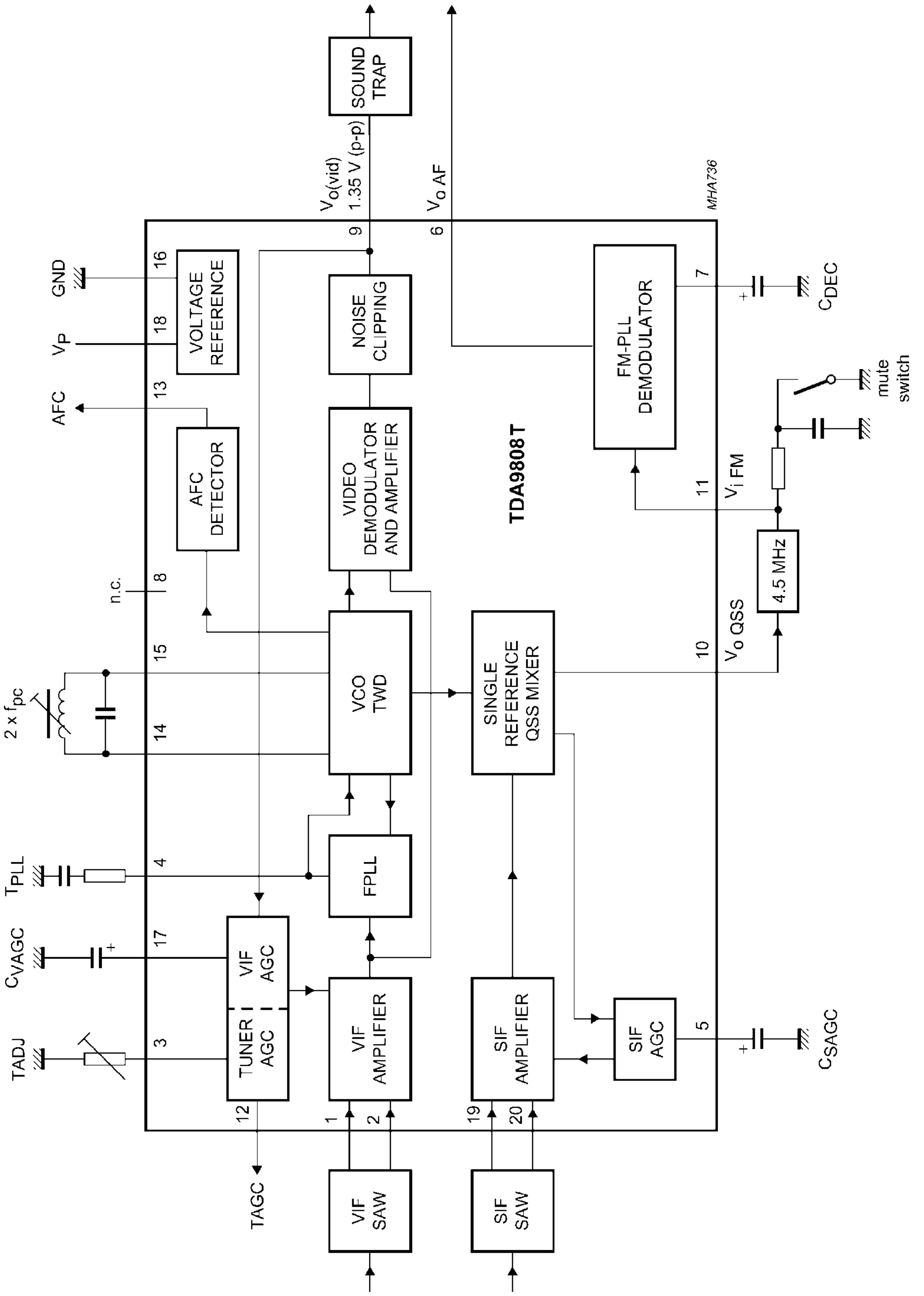


Fig. 14 Block Diagram

3. Refer to Table 11 about Functions and Service Data of TDA9808T′ s Each Pin.

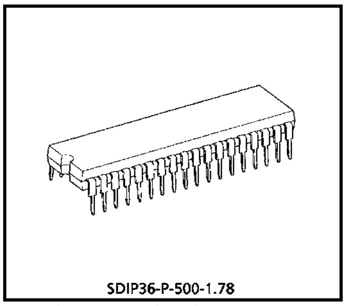
IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TA1219AN

Audio/Video Switching IC for TVs

The TA1219AN is an audio/video switching IC for TV Sets. Conforming to I^{2}C bus standards, it allows you to perform various switching operations through the bus lines by using a microcomputer. Furthermore, since the presence of a signal on its sync signal output pin can be determined by a microcomputer. it is possible to check each input/output channel (self-diagnosis).

This IC has the same pin assignments as the TA1218AN (SDIP42), a 2-channel output version of the TA1219AN, so these chips are pin compatible on pins 3 to 20 and 23 to 40 in TA1218AN.



Weight : 2.98g (Typ.)

1. Features

- I^{2}C bus control
- Video: 5-channel inputs and 1-channel outputs (2 channels conforming to S system)
- Audio: 5-channel inputs and 2-channel outputs
- Self-diagnostic function
- ADC inputs based on European 21-pin standards
- ADC inputs based on S1/S2 terminal standards
- Switchable subaddressa

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TA1219AN (continued)

2. Block Diagram

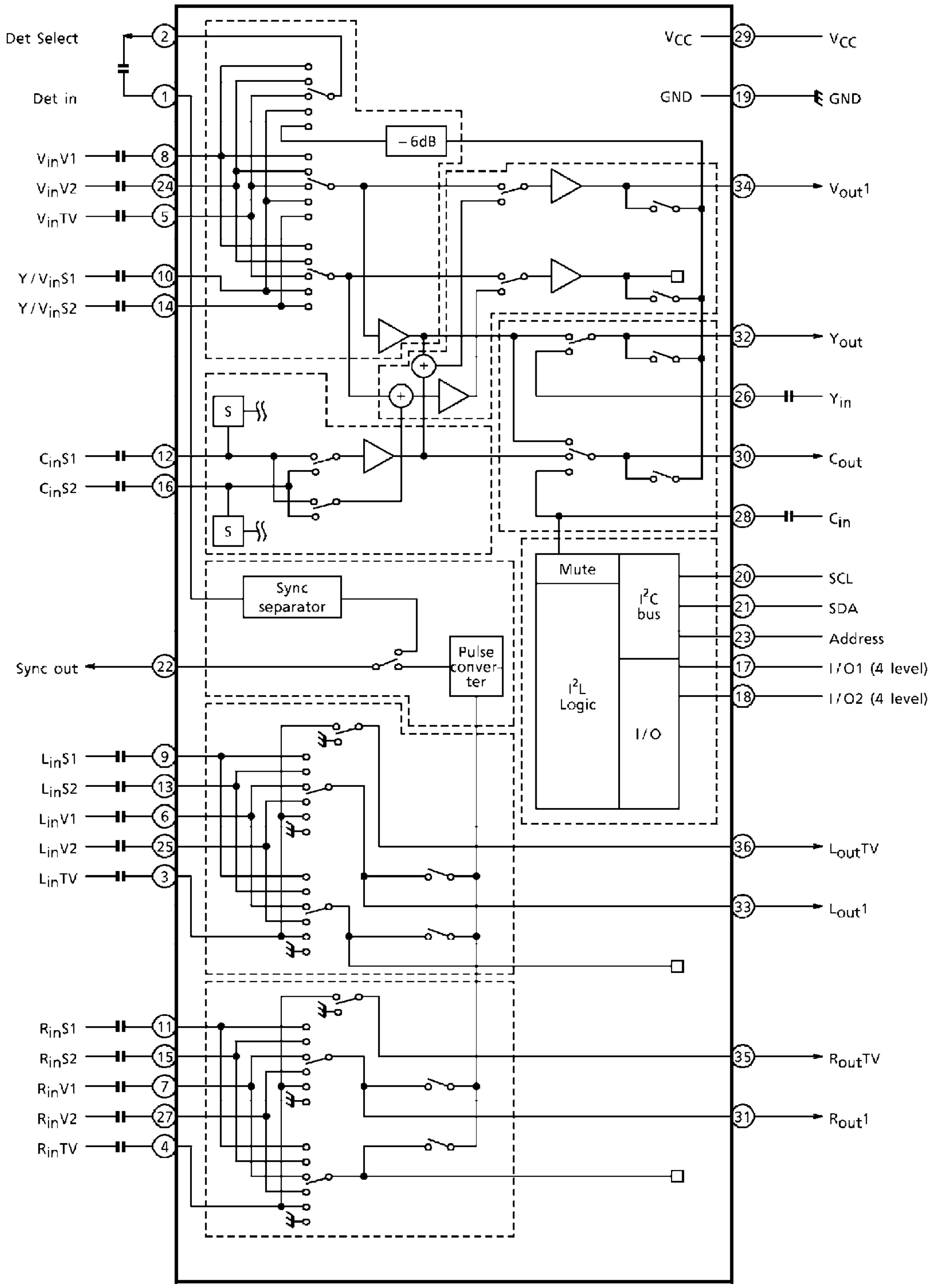


Fig. 15

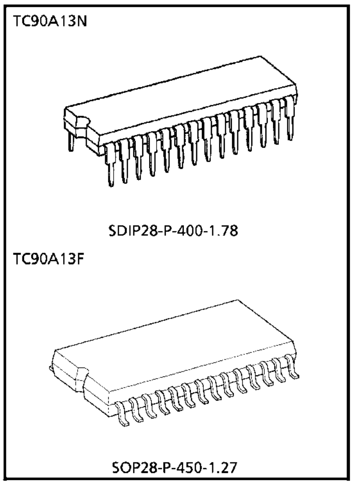
3.Refer to Table 12 about Functions and Service Data of TA1219AN′ s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

TC90A13N

3 Line Digital Y/C Separation IC

The TC90A13N and TC90A13F separate luminance (Y) and Chrominance(c(signals from an NTSC composite video Signal. Lt employs the Toshiba original logical comb filter To Realize high performance Y/C separation at low cost



Weight
SDIP28-P-400-1.78 : 1.7g (Typ.)
SOP28-P-450-1.27 : 0.8g (Typ.)

1. Features

- NTSC system
- PLL 4X multiplication circuit
- Sync. tip clamping circuit
- 8bit A/D converter
- 8bit D/A converters (2ch)
- 2H line memory
- Dynamic comb filter
- 1 line dot correction circuit
- Vertical enhancer
- Color killer mode (Y/C separation OFF)
- Chrominance wide band output mode
- SDIP28/SOP28 package
- 5V single power supply

2. Block Diagram

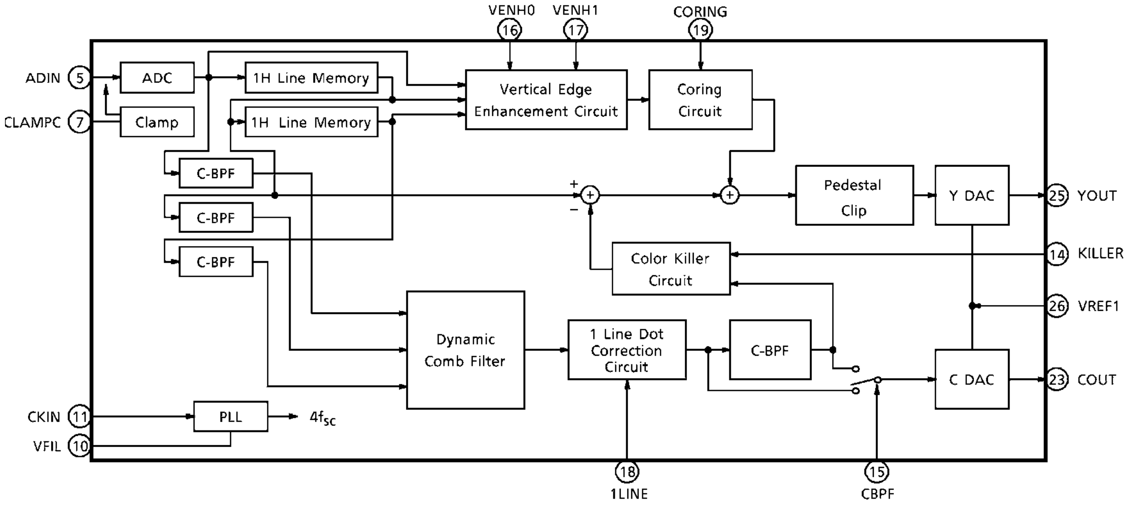


Fig. 16

3.Refer to Table 13 about Functions and Service Data of TC90A13N′ s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

MM1031

Video Amplifier

1. Outline

This IC is a 6dB amp for video signals (Y or composite signals). Gain is fixed at 6dB and it is used in 75e Signals). Gain is fixed at 6dB and it is used in 75Ω output circuits.

2. Features

1) For video signal (Y or composite) amplification

2) Built-in clamp circuit

3) 75Ω driver built in

4) Frequency response 7MHz

5) Current consumption 4mA typ.

6) Power supply voltage 5V

3. Block Diagram

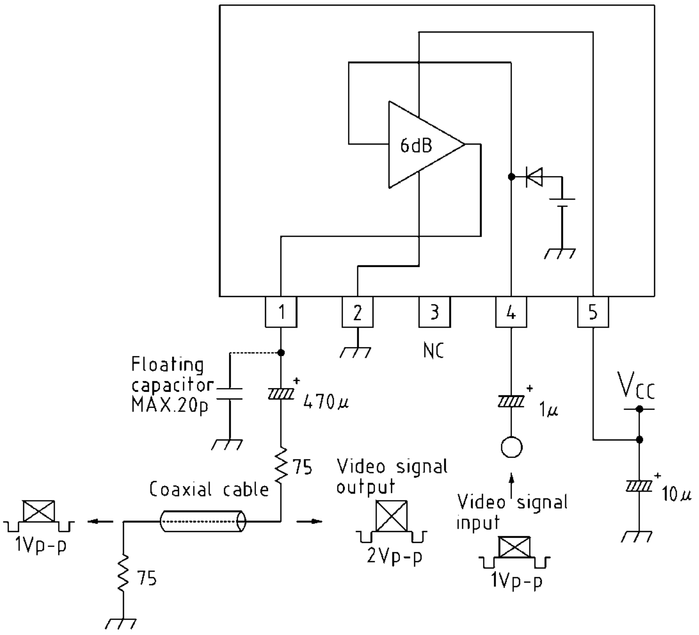


Fig. 17

4. Refer to Table 14 about Functions and Service Data of MM1031′s Each Pin.

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

Table 2 Functions and Service Data of STR-F6626 (NQ821)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	Overcurrent detection & voltage stabilization control input	1.87	0.687	0.6
2	Switch transistor's source	0.09	0.0001	0.
3	Switch transistor's drain	144	∞	∞
4	Control circuit power	17.85	∞	∞
5	Control circuit ground	0	0.001	0

Table 3 Functions and Service Data of LC86F3248AV-DIP (N001)′ s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	Not connected		9.45	5.33
2	Clock line	4.8	9.43	5.07
3	Data line	4.86	9.4	5.05
4	Not connected	0	0	4.75
5	Not connected	0	0	5.3
6	Not connected	0	0	5.38
7	VM circuit control	5	9.3	5.19
8	Not connected	0.2	9.4	5.38
9	Ground	1.91	0.001	0.00
10	Input terminal for clock oscillating signal	2.62	9.4	6.03
11	Output terminal for clock oscillating signal	5	8.9	6
12	Supply voltage	5	3.5	3.25
13	Button-control voltage input terminal	5	9.4	5.28
14	Button-control voltage input terminal	5	9.4	5.27
15	Standby indicator control	5	9.4	5.45
16	Not connected	5	9.2	5.5
17	Reset	5	4.6	4.47
18	Filter	2.83	9.1	5.44
19	Video signal input terminal	2.75	9.1	5.99
20	Input terminal for vertical flyback pulse	4.7	8.5	5.08
21	Input terminal for horizontal flyback pulse	4.08	8.6	5.08
22	R character output terminal	0.01	2.16	2.11
23	G character output terminal	0.01	2.1	2.11
24	B character output terminal	0.01	0.1	2.11
25	Output terminal for fast blanking signal	0.01	2	1.99
26	Character level clamping	0.01	9.2	5.81
27	Clock line 0	5	6.7	4.89
28	Data line 0	5	6.8	5.1

(Continued)

IC DATA AND WAVEFORMS OF KEY POINTS **(continued)**

29	Clock line 1	4	7	4.54
30	Data line 1	3.5-3.7	7	4.54
31	Overload detecting input terminal	5	3.6	3.34
32	Input terminal for selectable production modes	5	9.4	5.18
33	Not connected	0.01	9.2	5.46
34	Remote control input	5	9.3	5.43
35	Not connected	0.01	9.4	5.4
36	Comb filter direct-pass control	0.01	7	5.1
37	Mute	0	9.3	5.15
38	Not connected	0	9.4	5.34
39	Not connected	0	9.4	5.3
40	Not connected	0	9.3	5.38
41	Standby control	0	7	4.9
42	YUV switch control	0	5.9	4.93

Table 4 Functions and Service Data of AT24C08-10P (N002)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	Address input	0	0.001	0.00
2	Address input	0	0.001	0.00
3	Address input	0	0.001	0.00
4	Common ground	0	0.001	0.00
5	Clock line	5	7	4.83
6	Data line	4.99	6.9	5.15
7	PW write protect	4.99	9.5	5.31
8	Supply voltage	5	3.5	3.25

Table 5 Functions and Service Data of OM8839PS (N301)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	SIF signal input	0.28	7.9	6.03
2	External audio signal input	3.7	8.3	6.03
3	Reference frequency resonant coil terminal	0	∞	∞
4	Reference frequency resonant coil terminal	0	∞	∞
5	PLL filter	2.5	7.5	5.79
6	Video detection output	2.9	2.1	2.19
7	Clock line	3.5-3.6	6.6	4.56
8	Two-way transmission data line	4.02	6.6	4.56
9	Gap decoupling	6.73	7.3	5.66
10	SVHS chroma signal input	1.35	8	5.99
11	SVHS luminance signal input	4	8.3	5.88
12	Supply voltage	8	2.1	2.09

(Continued)

IC DATA AND WAVEFORMS OF KEY POINTS **(continued)**

13	Composite video signal input terminal	3.76	8.8	5.88
14	Ground	0	0.01	0.01
15	Audio signal output	4.39	8.3	5.96
16	Decoupling capacitor connection	0.01	∞	∞
17	Video input	0.41	8.13	5.88
18	Black current control input	5.62	8.5	5.81
19	Blue (B) signal output	2.58	0.17	5.08
20	Green (G) signal output	2.67	5.9	5.08
21	Red I signal output	2.56	5.9	5.08
22	Beam current control	1.9	7.6	5.84
23	Red I signal input	3.7	8	5.95
24	Green (G) signal input	3.7	8.2	5.95
25	Blue (B) signal input	3.7	8.2	5.95
26	Selectable primary color signal input control	0.06	1	0.99
27	Luminance signal input	2.58	6.6	5.83
28	Luminance signal output	2.58	6.7	5.92
29	B-Y color difference signal output	2.46	6.7	5.9
30	R-Y color difference signal output	2.42	6.7	5.9
31	B-Y color difference signal input	2.46	6.7	5.93
32	R-Y color difference signal input	2.42	6.7	5.93
33	Sub-carrier output for SECAM demodulation	4.32	7.1	5.82
34	3.58MHz crystal oscillator	2.52	7.5	5.91
35	4.43MHz crystal oscillator	2.52	7.7	5.91
36	APC low pass filter	5	2.3	5.9
37	Horizontal starting supply voltage	8	2.4	2.09
38	Composite video output	2.54	7.8	5.96
39	Black level stretch	5	8.5	4.69
40	Line drive pulse output	3.36	3	2.81
41	Horizontal flyback pulse input/ sandcastle pulse output	0.86	8.6	5.75
42	Line discriminator	3.95	8.7	5.87
43	Line discriminator	3.95	8.8	5.87
44	Ground	0	0.001	0.00
45	Vertical frequency parabola output	0.76	8.5	5.89
46	Field drive signal output	2.18	8.8	5.82
47	Field drive signal output	2.18	8.99	5.8
48	IF signal input	4.65	8.7	6.05
49	IF signal input	4.65	8.6	6.05
50	High voltage detection input	2.02	8.2	5.95
51	Vertical sawtooth generation	3.85	8.3	5.91
52	Vertical reference bias setting	3.89	8.4	5.96
53	AGC filter for IF amplifier	4.47	8.6	5.89
54	AGC output for IF amplifier	1.41	9.9	5.69
55	Audio deemphasis	2.91	8.1	5.87
56	Audio decoupling	0.5	8.4	5.89

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

Table 6 Functions and Service Data of TDA8350Q-N6 (N401)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	Vertical drive input (positive)	2.16	9	5.8
2	Vertical drive input (negative)	2.16	9	5.83
3	Feedback input	10.09	5.8	4.71
4	Supply voltage	19.49	6.4	4.2
5	Output 1	10.09	5.8	4.71
6	Not connected	0	∞	∞
7	Ground	0	0.001	0.00
8	Pump supply voltage input	51.3	∞	∞
9	Output 2	9.85	9.8	4.7
10	Guard output	0.28	9.1	5.88
11	Pincushion output	20	9	5.24
12	Pincushion input (negative)	0.71	8.5	6.97
13	Pincushion input (positive)	0	0.01	6.88

Table 7 Functions and Service Data of TDA7057AQ (N601)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	Volume control input	0.99	15.3	6.15
2	Not connected	0	∞	∞
3	Audio R signal input	2.4	∞	6.51
4	Supply voltage	16	9	0.47
5	Audio L signal input	2.4	∞	6.51
6	Ground	0	0.001	0.00
7	Volume control input	1	15.6	0.15
8	Left channel in-phase signal output	8	12.3	5.59
9	Ground	0	0.001	0.00
10	Left channel inverting signal output	8	12.6	5.59
11	Right channel inverting signal output	8	12.6	5.59
12	Ground	0	0.001	0.00
13	Right channel in-phase signal output	8	12.6	5.59

Table 8 Functions and Service Data of TDA6108JF's Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	G inverting input	2.7	5.4	4.72
2	R inverting input	2.6	5.4	4.72
3	B inverting input	2.7	5.4	4.72
4	Ground	0	0.001	0.00
5	Black level current input	6.25	17.3	5.65

(Continued)

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

6	Supply voltage	199.66	∞	4.48
7	B output	127.69	∞	5.45
8	R output	122.7	∞	5.45
9	G output	109	∞	5.45

Table 9 Functions and Service Data of HEF4053 (ND01)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	Signal input terminal	0.01	6.9	6.32
2	Signal input terminal	2.47	6.7	5.89
3	Signal input terminal	0.21	6.9	6.4
4	Signal output terminal	2.59	6.7	5.83
5	Signal input terminal	2.58	6.7	5.91
6	Ground	0	0.001	0.00
7	Ground	0	0.001	0.00
8	Ground	0	0.001	0.00
9	Control signal input terminal	0.15	5.7	4.93
10	Control signal input terminal	0.15	5.7	4.93
11	Control signal input terminal	0.15	5.7	4.93
12	Signal input terminal	2.5	6.5	5.9
13	Signal output terminal	0	6.7	6.38
14	Signal input terminal	2.49	6.5	5.9
15	Audio output	2.45	6.5	5.94
16	Supply voltage	8.2	1.2	1.57

Table 10 Functions and Service Data of MSP3440 (N606M)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	TP NC	0.16	7.3	5.3
2	AVD-GL-OUT NC	2.52	6.8	5.51
3	D-CTR-I/O-1 NC	0.01	7.3	5.57
4	D-CTR-I/O-0 NC	0.01	7.2	5.58
5	ADR-SEL	4.79	0.7	4.54
6	STANDBYQ	4.79	0.7	4.54
7	I2C-CL	3.56	7	4.44
8	I2C-DA	3.9	7	4.44
9	I2S-CL NC	2.36	7.2	6.24
10	I2S-WS NC	2.4	7.2	6.24
11	I2C-DA-WT NC	2.36	7.2	6.24
12	I2S-DA-IN1 NC	0.07	7.2	5.29
13	ADR-DA NC	0.07	7.2	5.59
14	ADR-WS NC	0.07	7.2	5.59
15	ADR-CL NC	0.07	7.2	5.59
16	DVSVP	4.79	0.7	4.54
17	DVSS	0.01	0.001	0.00

(Continued)

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

18	I2S-DA-IN2 NC	0.07	7.3	5.31
19	NC	0	∞	∞
20	RESETQ	4.76	7	5.24
21	DACA-R NC	0.8	3.5	3.54
22	DACA-L NC	0.08	3.5	3.52
23	VREF-I	0.01	0.001	0.00
24	DACM-R	0.17	3.5	3.52
25	DACM-L	0.08	3.5	3.54
26	DACM-SVB NC	0.18	3.6	3.6
27	SC2-OUT-R NC	3.82	7.1	5.92
28	SC2-OUT-L NC	3.82	7.1	5.91
29	CREF 1	0.01	0.001	0.00
30	SC1-OVT-R	3.82	7.1	5.91
31	SC1-OUT-L	3.82	7.1	5.92
32	SAPL-A	7.19	7.1	6.04
33	AHVSUP	8	1.3	4.59
34	CAPL-M	7.2	7.1	6.04
35	AHVSS	7.2	7.1	0.00
36	ABNDC	0.01	0.001	6.02
37	SC3-ZN-L NC	3.74	7.1	6.1
38	SC3-IN-R NC	3.77	7.1	6.1
39	SC2-IN-L NC	3.77	7.1	6.1
40	SC2-IN-R NC	3.77	7.1	6.1
41	SC1-IN-L	3.77	7.1	6.1
42	SC1-IN-R	3.77	7.1	6.1
43	VREFTOP	2.6	1.6	1.63
44	WONO-IN NC	3.78	7	6.1
45	AVSS	0.01	0.001	0.00
46	AVSVP	4.9	0.7	4.53
47	ANA-IN1+	1.53	7.3	5.27
48	ANA-IN1-	1.53	7.3	5.26
49	ANA-IN2+	0.09	7.3	5.27
50	TESTEN	0.01	0.001	0.00
51	XTAL-2N	2.35	6.8	5.27
52	XTAL-OUT	2.36	6.8	5.3

Table 11 Functions and Service Data of TDA9808T (NQ102)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	PIF signal input 1	3.23	7.2	6.03
2	PIF signal input 2	3.23	7.2	5.99
3	RFAGC start-control level adjust	0.99	6.7	5.85
4	PLL APC filter	2.53	7.9	6.3
5	Audio AGC filter	3.29	7.8	6.17
6	Audio output (NTSC 4.5MHz)	2.34	7.2	5.86

(Continued)

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

7	Filter	1.79	7.9	6.29
8	1/2VCC comparison voltage bias	0	∞	∞
9	Video output	2.18	7.6	6.09
10	Second SIF signal output	2.03	7.7	6.17
11	Second SIF signal input	2.81	5.2	4.99
12	RFAGC output	0.04		6.1
13	AGC signal output	3.05	7.9	6.2
14	External connection for VCO oscillating LC network	2.76	7	6
15	External connection for VCO oscillating LC network	2.76	7	6
16	Ground	0	0.001	0.00
17	AGC filter	3.13	7.9	6.11
18	Supply voltage input terminal	8	2.1	2.7
19	SIF signal input	3.2	2.1	6.27
20	SIF signal input	3.2	7	6.27

Table 12 Functions and Service Data of TA1219AN (DS01)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	Get Select	6.44	7.9	5.77
2	Get Select	3.03	7.9	5.73
3	Lin TV	5	7.5	5.89
4	RinTV	5	7.5	5.91
5	VinTV	5	7.5	5.89
6	LinTV1	5	7.6	5.89
7	RinTV1	5	7.7	5.89
8	VinTV1	5	7.5	5.89
9	LinS1	5	7.5	5.89
10	Y/VinS1	5	7.6	5.89
11	RinS1	5	7.6	5.88
12	CinS1	0.04	7.6	0.00
13	LinS2	5	7.6	5.87
14	Y/VinS2	5	7.6	5.87
15	RinS2	4.9	7.6	5.86
16	CinS2	0.04	7.6	5.64
17	I/O1	6.9	7.9	5.43
18	I/O2	0.04	7.9	5.44
19	GND	0.01	0.001	0.00
20	Scl	3.71	6.5	4.47
21	SDA	3.9	6.9	4.46
22	Sync out	0.2	7.9	5.45
23	Address	0.01	0.001	0.00
24	VinV2	5	7.65	5.81

(Continued)

IC DATA AND WAVEFORMS OF KEY POINTS **(continued)**

25	LinTV2	5	7.6	5.82
26	Yin	5	7.7	5.82
27	RinV2	5	7.6	5.82
28	Vin	5	7.8	5.6
29	Vcc	8	4.9	4.1
30	Cout	3.41	5.2	0.2
31	Rout1	3.89	0.2	5.46
32	Yout	3.42	7.4	0.2
33	Lout1	3.89	0.2	5.46
34	Vout1	4	7.4	0.2
35	RoutTV	3.89	0.2	5.48
36	LoutTV	3.89	7.4	5.48

Table 13 Functions and Service Data of TC90A13N (NK02)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	Bios fos ACD	1.46	0.4	0.42
2	GND for ACD	0.01	0.001	∞
3	VDD for ACD	4.83	0.7	0.91
4	Bios for ACD	3.37	0.7	0.78
5	Video input	2.22	6.7	5.79
6	Bios for ACD	1.44	6.7	5.91
7	Clamp filter	3.18	6.7	5.92
8	Test terminal	0.01	0.001	0.00
9	Bios for line memory	2.44	5	4.73
10	Vco filter	1.57	6.7	5.92
11	Clock input	2.25	6.7	5.92
12	VDD for PLL	4.83	0.6	0.91
13	GND for PLL	0.01	0.001	0.00
14	L:Color; H:B/W mode	0.07	6.5	5.45
15	CBPF	0.01	0.001	0.00
16	VENHO	0.01	0.001	0.00
17	VENH1	0.01	0.001	0.00
18	IL LINE	4.83	0.7	0.91
19	CORING	0.01	0.001	0.00
20	VDD3	4.82	0.7	0.91
21	VSS3	0.01	0.001	0.00
22	BIAS3	3.44	6.6	5.91

(Continued)

IC DATA AND WAVEFORMS OF KEY POINTS (continued)

23	C OUT	3.83	1.2	1.39
24	BIAS2	1.7	6.8	5.92
25	Y OUT	3.54	1.2	1.39
26	VREF1	2.88	0.7	4.89
27	VDD4	4.83	0.7	0.91
28	VSS4	0.01	0.001	0.00

Table 14 Functions and Service Data of MM1031x5 (NK03)'s Pins

Pin No.	Function Description	Digital Multimeter		
		Reference Voltage(V)	Positive Resistance (20KΩ)	Negative Resistance (20KΩ)
1	Video signal amplification	2.08	7	5.6
2	Build-in clamp circuit	0.01	0.001	0.00
3	Build-in 75 drive	0	∞	∞
4	Current consumption	2.3	6.7	5.93
5	Supply voltage	4.83	0.7	0.91

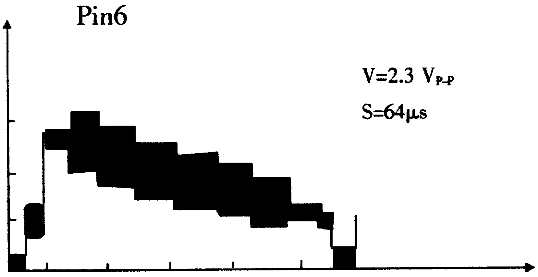
Table 15 Each Electrode Voltage of Key Triodes

Description		DC Voltage(V)		
Serial No.	Parts	Base	Collector	Emitter
V001	C1851Y	0.03	4.69	0.01
V002	C1851Y	0.13	4.12	0.01
V104	C388A	2.04	7.87	1.28
V227	C1851Y	2.53	12.09	1.9
V432	BSN274	0.550	26.74	0.01
V433	BU2720DF	0	100	0

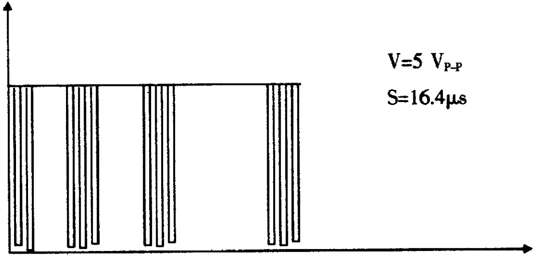
IC DATA AND WAVEFORMS OF KEY POINTS (continued)

1.OM8839PS(N301)′ s Pin6, Pin7, Pin8, Pin47,

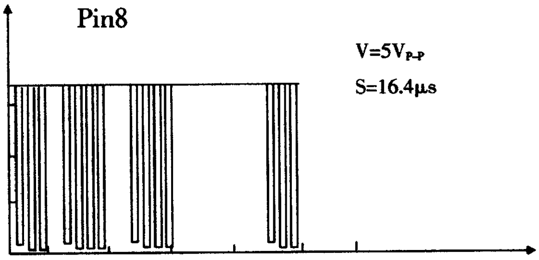
Pin6



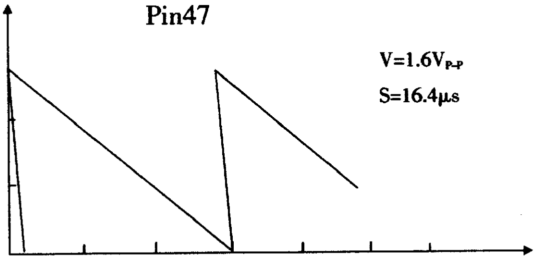
Pin7



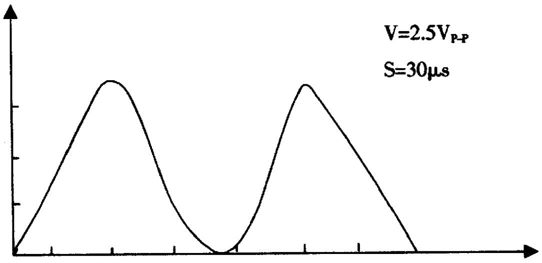
Pin8



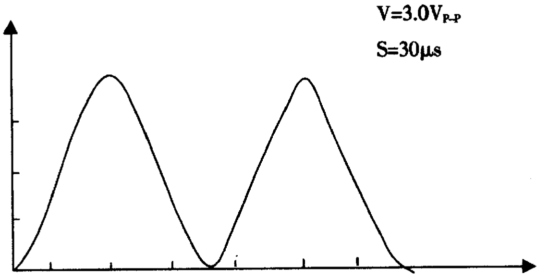
Pin47



N001′s Pin10



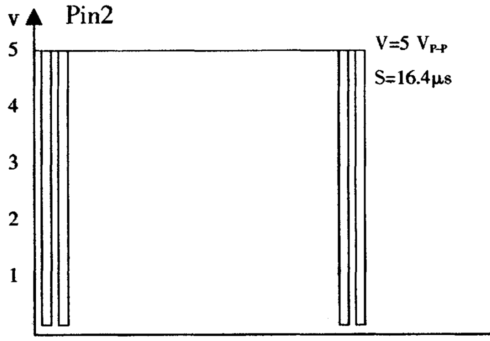
N001′s Pin11

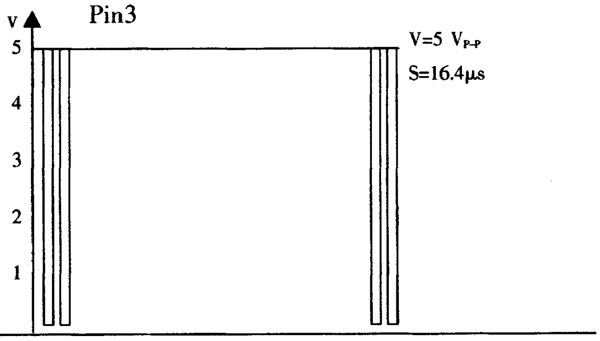


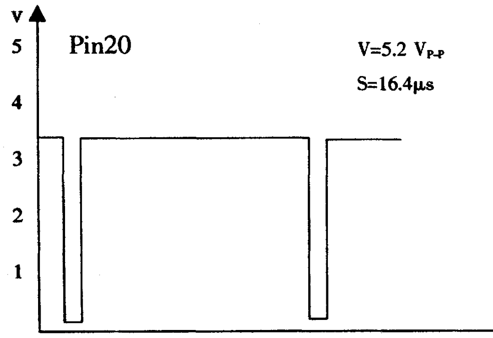
IC DATA AND WAVEFORMS OF KEY POINTS (continued)

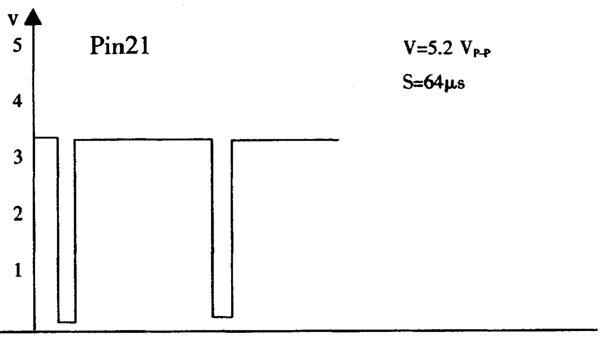
2. LC86F3248AU-DIP (N001)′ s

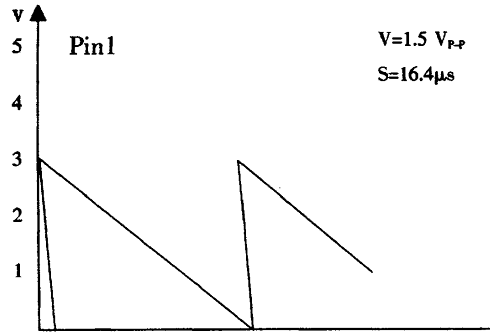
Pin2, Pin3, Pin10, Pin11, Pin20, Pin21, Pin29, Pin30

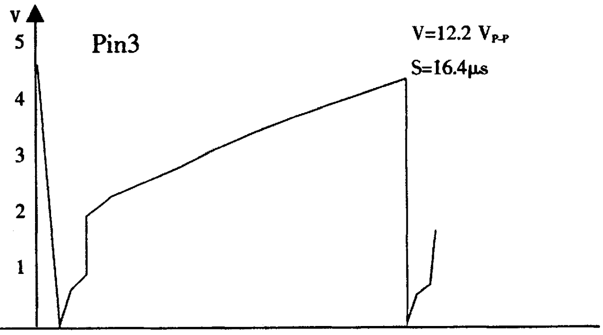


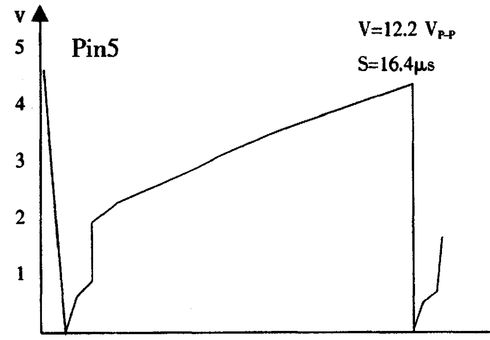


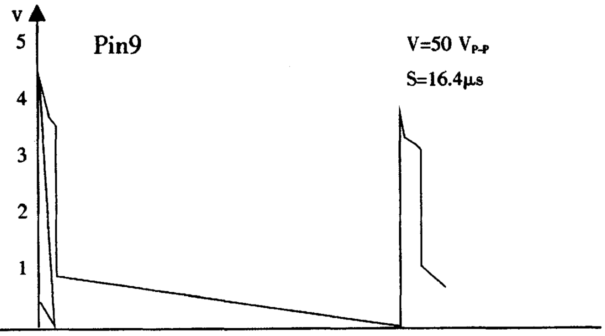






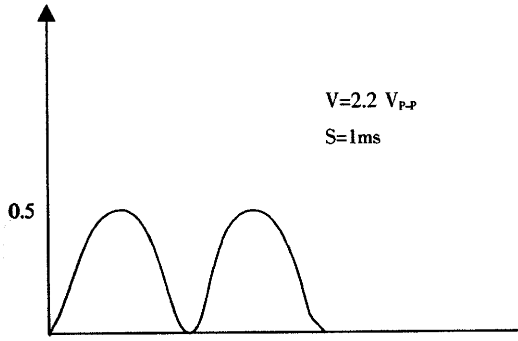




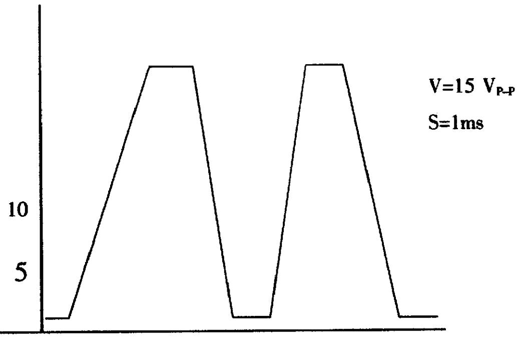


IC DATA AND WAVEFORMS OF KEY POINTS (continued)

Pin3,Pin5



Pin8, Pin10,Pin13



Measure with a GOS-622G oscilloscope.

CIRCUIT ADJUSTMENTS

1. General Description

All adjustments are thoroughly checked and corrected before the TV outgoing. Therefore the TV should operate normally and deliver proper colour pictures upon installation. However, several minor adjustments may be required depending on the particular location where the TV is operated.

This TV is shipped completely in carton. Carefully take out the TV from the carton and remove all packing materials. Connect the power cord into a 120V AC, 60Hz two-pin power outlet. Turn on the TV. Check and adjust all the customer controls such as brightness, contrast and colour to obtain natural colour pictures.

4. Automatic Degaussing

A degaussing coil is mounted around the CRT so that external degaussing after moving the TV is generally unnecessary□ providing it is properly degaussed upon installation. The degaussing coil operates in about 1 second after power on. If the set is moved or faced to a different direction, the power switch must be switched off for at least 30 minutes in order that the automatic degaussing circuit operates properly. Should the chassis or parts of the cabinet become magnetized to cause poor colour purity, use an external-degaussing coil. Slowly move the degaussing coil around the screen, the sides and front of the TV and slowly withdraw the coil to a distance of about 2m before unplug it. If colour shading still exists, perform the Colour Purity Adjustment and Convergence Adjustment procedures.

3. Supply Voltage Adjustment

Caution: +B voltage has close relation to high voltage. To avoid X-ray radiation, +B voltage should be +135V.

1) Set AC power supply to 120±2V.
2) Connect a digital voltmeter to two pins of C845, and then turn on the TV.
3) Receive Philips test pattern signals.
4) The voltmeter should read 135±0.5V.

4. High Voltage Inspection

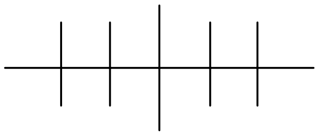
Caution: No high voltage adjustment should be done in the chassis.

1) Connect a precise high voltmeter to the second anode of the CRT.
2) Turn on the TV and set the brightness and contrast to minimum (i.e. set beam current of the CRT to zero).
3) The high voltage tested should be 28.8±0.8KV for 29” and 26.5±0.8KV for 25”.
4) Set the brightness to minimum or maximum, and ensure high voltage not beyond limitation of 31KV in any case.

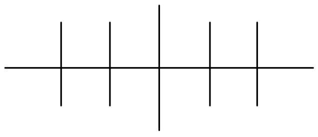
5. Focus Adjustment

1) Use the remote control to set the contrast to maximum and the brightness, chroma to medium.
2) Set H. V. lines near Philips pattern center to thinnest with the FCB on the FBT. After finishing adjustment, ensure that no poor focusing exists near the center or around of the frame.

CIRCUIT ADJUSTMENTS (continued)



Before Adjusting



After Adjusting

SET-UP ADJUSTMENTS

- The following adjustments should be made when a complete realignment is required or a new CRT is installed. Perform the adjustments in order as follows.

1. Colour purity
2. Convergence
5. White Balance

Note：

The purity/convergence magnet assembly and rubber wedges need mechanical positioning. Refer to Fig. 18.

1. Colour Purity Adjustment

Note：

Before attempting any purity adjustment, the TV should be operated for at least 15 minutes.

1）Demagnetize the CRT and cabinet using a degaussing coil.

2）Set the brightness and contrast to maximum.

3）Receive the green raster test signals.

4）Loosen the clamp screw holding the deflection yoke and slide it backward or forward to display vertical green belt (zone) on the screen.

5）Remove the rubber wedge.

6）Rotate and spread the tabs of the purity magnet around the neck of the CRT until the green belt is on the centre of the screen.

7）Slowly move the deflection yoke forward or backward until a uniform green screen is obtained. Tighten the clamp screw of the yoke temporarily.

8）Check purity of the red and blue raster.

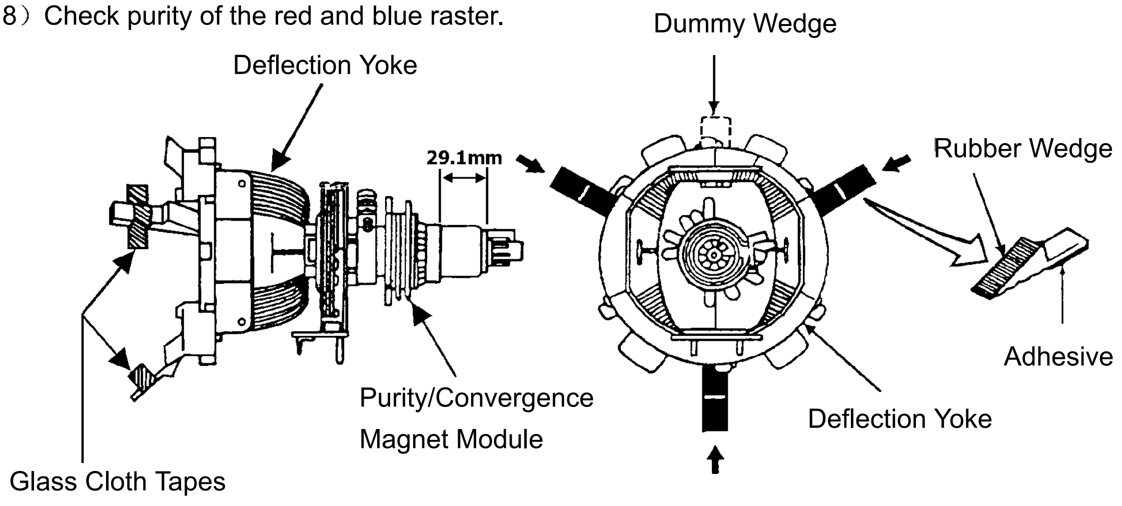
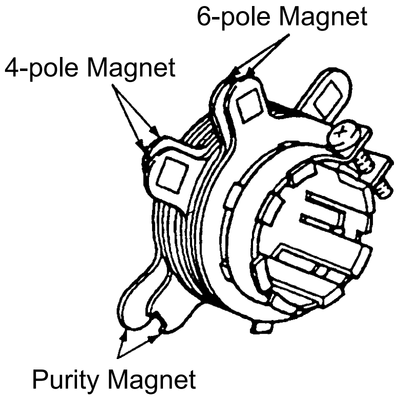


Fig. 18

SET-UP ADJUSTMENTS (continued)



Convergence Magnet Assembl y

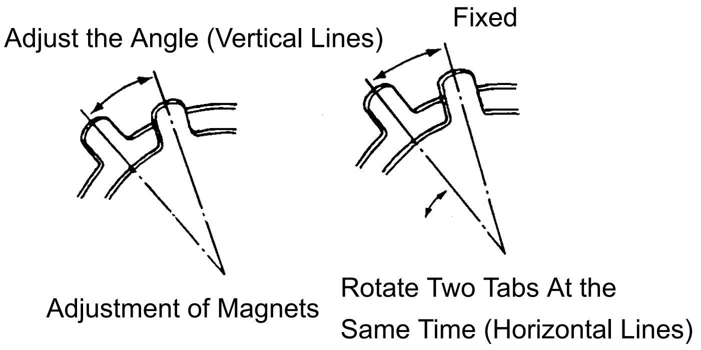

Adjust the Angle (Vertical Lines)
Fixed
Adjustment of Magnets
Rotate Two Tabs At the Same Time (Horizontal Lines)

Fig. 19

2. Convergence Adjustment

Note:

Before attempting any convergence adjustment, the TV should be operated for at least 15 minutes.

- Center convergence adjustment

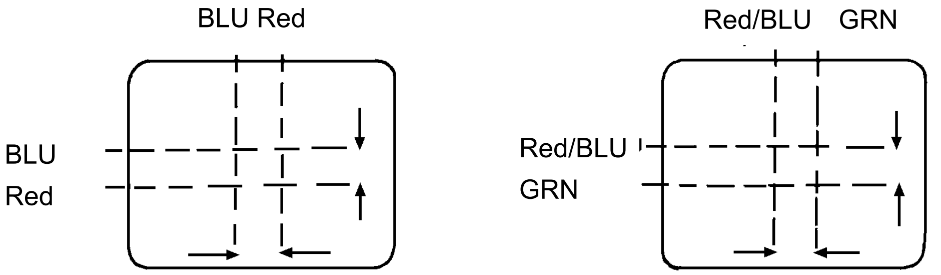
1) Receive the grille test pattern signals.
2) Set the brightness and contrast properly.
3) Adjust two tabs of the 4-pole magnet to change the angle between them and red and blue vertical lines are superimposed on the center area of the screen.
4) Turn both tabs at the same time keeping the angle constant to superimpose red and blue horizontal lines on the center of the screen.
5) Adjust two tabs of 6-pole magnet to superimpose red/blue line and green line. Adjusting the angle affects the vertical lines and rotating both magnets affects the horizontal lines.
6) Repeat steps 3)～5) keeping in mind red, green and blue movement. 4-pole magnet and 6-pole magnet interact each other, resulting in complicating and dot movement.

- Circumference convergence adjustment

1) Loosen the clamping screw of the defection yoke slightly to allow it to tilt.
2) Temporarily put a wedge as shown in Fig.18. (Do not remove cover paper on adhesive part of the wedge.)
3) Tilt front of the deflection yoke up or down to obtain better convergence in circumference. Push the mounted wedge into the space between the CRT and yoke to fix the yoke temporarily.
4) Put other wedge into bottom space and remove the cover paper to stick.
5) Tilt front of the deflection yoke right or left to obtain better convergence in circumference.
6) Keep the deflection yoke position and put another wedge in either upper space. Remove cover paper and stick the wedge on the CRT to fix the yoke.
7) Detach the temporarily mounted wedge and put it in another upper space. Stick it on the CRT to fix the yoke.
8) After fixing three wedges, recheck overall convergence. Tighten the screw firmly to fix the yoke and check if the yoke is fixed.

SET-UP ADJUSTMENTS (continued)

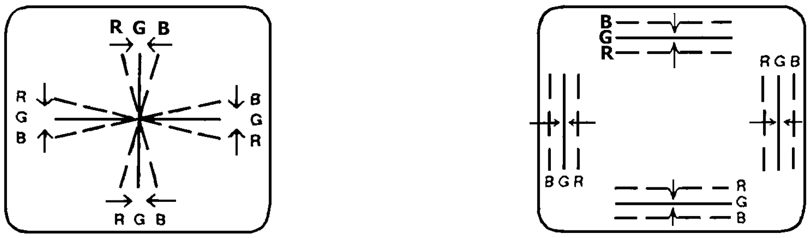
9) Stick three adhesive tapes on wedges as shown in Fig. 18.



4-pole Magnet Movement

6-pole Magnet Movement

Center Convergence by Convergence Magnets



Incline the Yoke up (or down)

Incline the Yoke Right(or Left)

Circumference Convergence by DEF Yoke

Fig. 20

SERVICE MODE AND BUS DATA

1. To Enter the Service Mode

1) Decrease the volume to 0 with the remote control.
2) Press the MUTE button on the remote control and VIDEO button on the TV at the same time. “S” appears on the TV screen and the TV enters the Service mode.
3) Press the ↓ , ↑ , ← or → button to adjust data.
4) Press the ⏻ button on the remote control to exit from the mode.

SERVICE MODE AND BUS DATA (continued)

Item	Symbol Description	Bus Data
MENU.00		
V.POS /50H	VERTICAL POSITION /50Hz	34
H.PHSH /50H	HORIZONTAL PHASE /50Hz	8
V.SIZE /50H	VERTICAL SIZE /50Hz	84
V.POS /60H	VERTICAL POSITION /60Hz	37
V.PH /60H	HORIZONTAL PHASE /60Hz	13
V.SIZE /60H	VERTICAL SIZE /60Hz	55
V.SC	VERTICAL S-CORRECTION	4
V,LINE	VERTICAL LINE	18
V.SIZE CMP	VERTICAL SIZE COMPENSATION	7
MENU.01		
SUB.BIGHT	SUB-BRIGHT	59
SUB.CONT	SUB-CONTRAST	63
V.KILL	VERTICAL KILL	0
RF.AGC	RF AGC	15
R.BIAS	RED BIAS	32
G.BIAS	GREEN BIAS	60
B.BIAS	BLUE BIAS	16
R.DRIVE	RED DRIVE	72
G.DRIVE	GREEN DRIVE	15
B.DRIVE	BLUE DRIVE	93
MENU.02		
H.AFC	HORIZONTAL APC GIAN	0
H.BLK.L	HORIZONTAL BLANKING LEFT	4
H.BLK.R	HORIZONTAL BLANKING RIGHT	4
CROS.B/W	CROSSHATCH BLACK/WHITE	0
VIDEO.LVL	VIDEO LEVEL	4
FM.LEVEL	FM LEVEL	1
MENU.03		
FM.MUTE	FM MUTE	0
AUDIO.MUTE	AUDIO MUIE	0
VIDEO.MUTE	VIDEO MUTE	0
SND.TRAP	SOUND TRAP	0
MENU.04		
SUB.COLOR	SUB COLOR	31
SUB.TINT	SUB TINT	24
S.SHARP	SUB SHARP	31
CORING.	CORING GAIN	1
C.EXT	EXTERNAL CHROMA	0
C.BYPASS	CHROMA BAND-PASS BYPASS	0

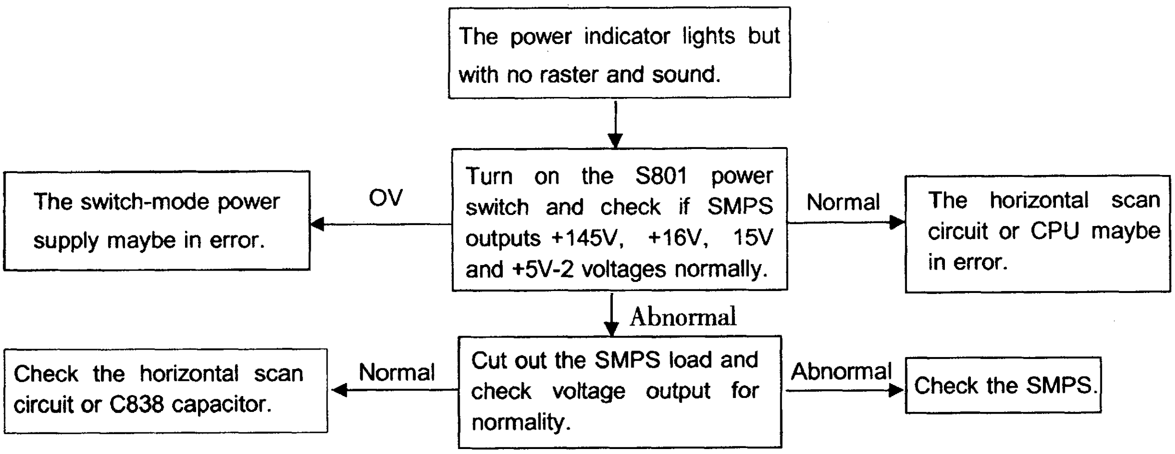
SERVICE MODE AND BUS DATA (continued)

C.KILL ON	COLOR KILL ON	0
MENU.05		
BLANK.DEF	BLANK DEFEAT	0
BLK.ST.DEF		1
FBP.BLK.SW	FLYBACK PULSES （HORIZONTAL） BLANKING SWITCH	0
FILT.SYS	FILTER SYSTEM：SELECT Y/C FILTER MODE	0
VOL.FIL	VOLUME FILTER	0
VIF.SYS.SW	VIF SYSTEM SWITCH	0
VIDEO.SW	VIDEO SWITCH	0
MENU.06		
R/B ANGLE	R-Y/B-Y ANGLE	9
GREY MODE	GREY MODE	0
V.SETUP	VERTICAL SETUP	1
B.GAM.SEL		3
RG.GAM.DEF		1
MENU.07		
BRT.ABL.TH	BRIGHT ABL THRESHOLD	7
EM.ABL.DEF		0
BRT.ABL.DF	BRIGHT ABL DEFEAT	1
MID.STP.DF	BRIGHT MID STOP DEFEAT	1
MENU.08		
DIGITAL.OSD	DIGITAL OSD MODE	0
OSD.CONT	OSD CONTRAST CONTROL	1
OSD.H.POS	OSD HORIZONTAL POSITION	22
MENU.09		
H.FREQ	HORIZONTAL FREQUENCY	27
C.KILL.OFF	COLOR KILL OFF	0
AUDIO.SW	AUDEO SWITCH	0
T.DISBLE	TEST MODE SWITCH DISABLE	1
OPT.LOGO	OPTION LOGO	0
OPT.VID SW	OPTION VIDEO SWITCH	0
MENU.10		
OPT.TV.AV	OPTION TV/AV	1
OPT.AV1/2	OPTION AV1/2	
OPT.AV3	OPTION AV3	
OPT.COLOR	OPTION COLOR	0
OPT.V-CHIP	OPTION V-CHIP	1
OPT.CCD	OPTION CCD	1
OPT.CLOCK	OPTION CLOCK	1
OPT.P-ON	OPTION P-ON	0
SRCH.SPEED	SEARCH SPEED	0
ROM.CORREC	ROM CORRECTION	0

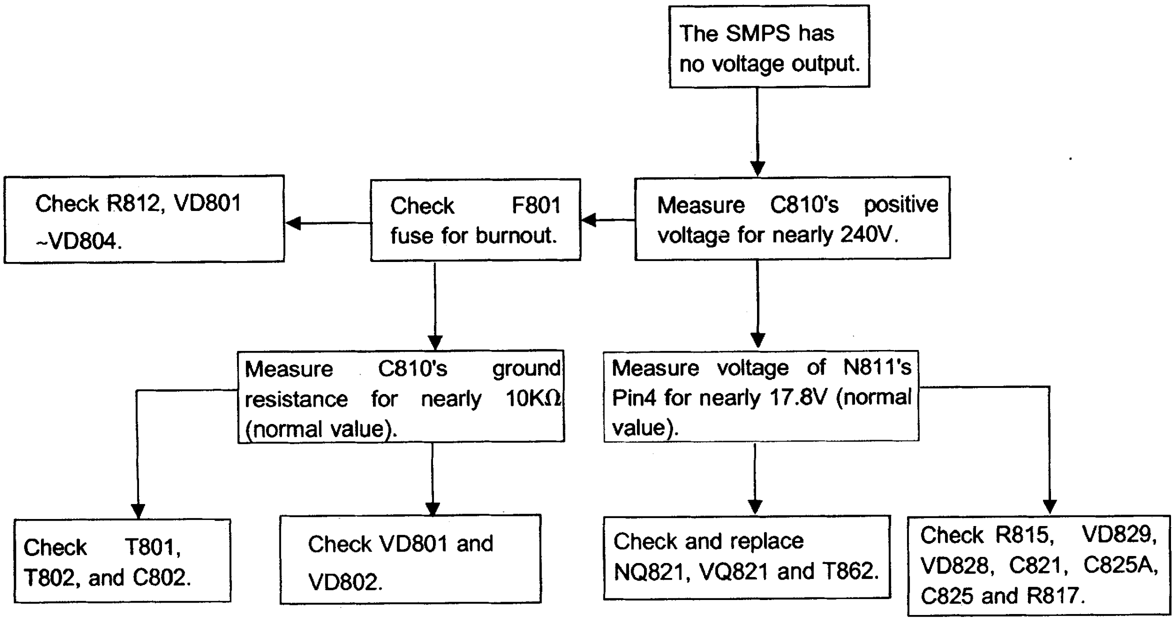
TROUBLESHOOTING FLOW CHARTS

1. Power On/Off

1.1 The power indicator lights but with no raster and sound.

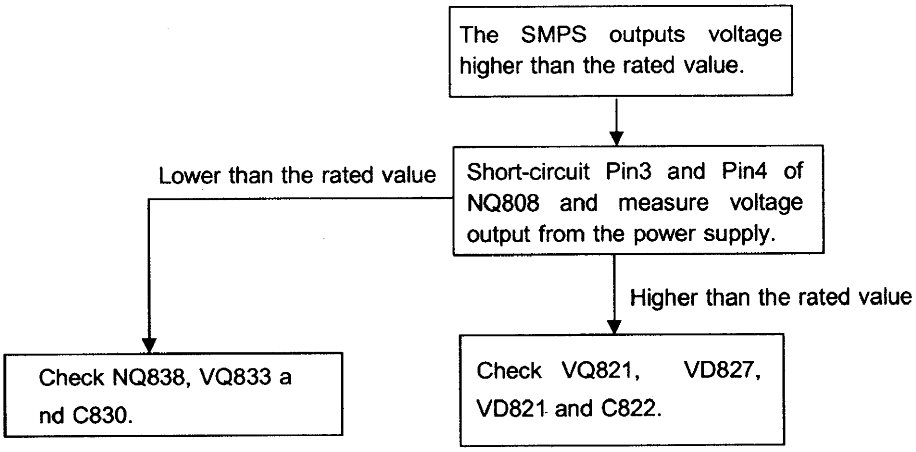

The power indicator lights but with no raster and sound.
Turn on the S801 power switch and check if SMPS outputs +145V, +16V, 15V and +5V-2 voltages normally.
OV
The switch-mode power supply maybe in error.
Normal
The horizontal scan circuit or CPU maybe in error.
Abnormal
Cut out the SMPS load and check voltage output for normality.
Normal
Check the horizontal scan circuit or C838 capacitor.
Abnormal
Check the SMPS.

1.2 The SMPS has no voltage output.

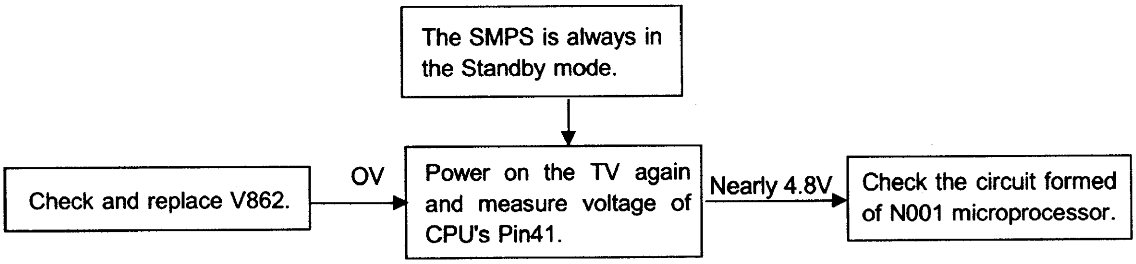

The SMPS has no voltage output.
Measure C810's positive voltage for nearly 240V.
Check F801 fuse for burnout.
Check R812, VD801 ~VD804.
Measure C810's ground resistance for nearly 10KΩ (normal value).
Measure voltage of N811's Pin4 for nearly 17.8V (normal value).
Check T801, T802, and C802.
Check VD801 and VD802.
Check and replace NQ821, VQ821 and T862.
Check R815, VD829, VD828, C821, C825A, C825 and R817.

TROUBLESHOOTING FLOW CHARTS(continued)

1.3 The SMPS outputs voltage higher than the rated value.

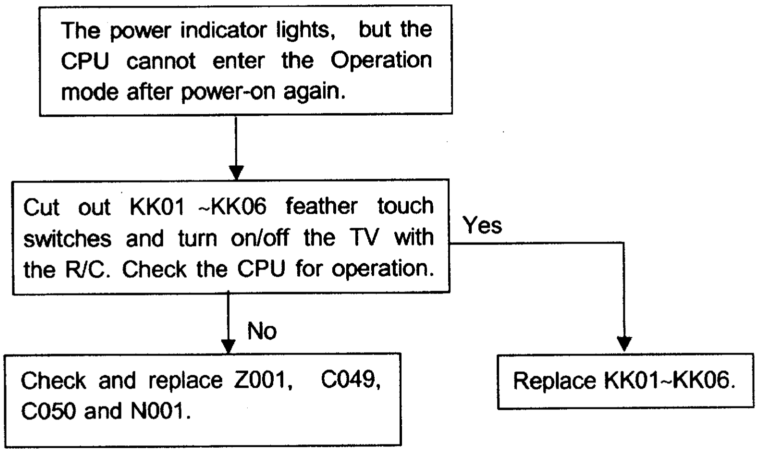

The SMPS outputs voltage higher than the rated value.
Short-circuit Pin3 and Pin4 of NQ808 and measure voltage output from the power supply.
Lower than the rated value
Higher than the rated value
Check NQ838, VQ833 and C830.
Check VQ821, VD827, VD821 and C822.

1.4 The power indicator lights, but the SMPS is still in the Standby mode.


The SMPS is always in the Standby mode.
Power on the TV again and measure voltage of CPU's Pin41.
OV
Check and replace V862.
Nearly 4.8V
Check the circuit formed of N001 microprocessor.

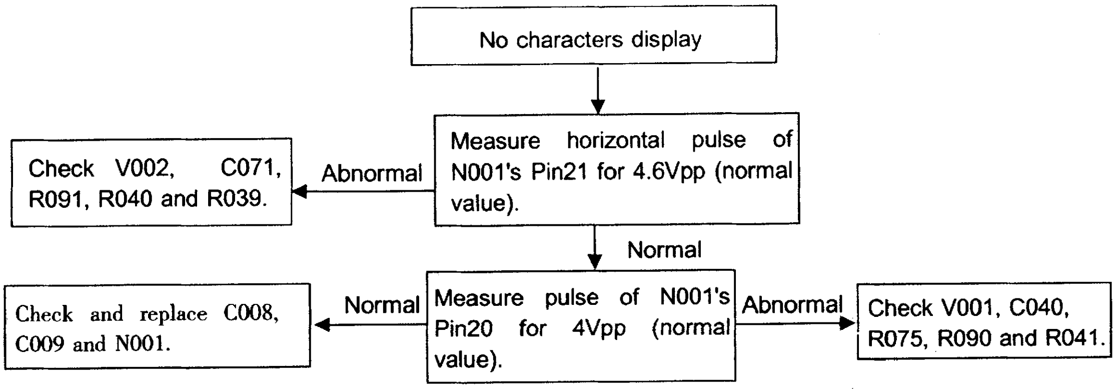
2. Control System

2.1 The power indicator lights, but the CPU cannot enter the Operation mode after power-on again.

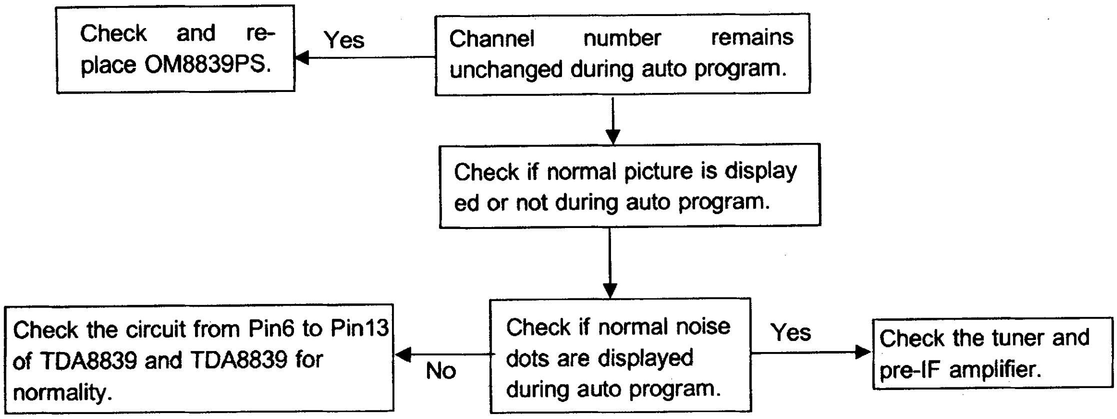

The power indicator lights, but the CPU cannot enter the Operation mode after power-on again.
Cut out KK01 ~KK06 feather touch switches and turn on/off the TV with the R/C. Check the CPU for operation.
Yes
No
Check and replace Z001, C049, C050 and N001.
Replace KK01~KK06.

TROUBLESHOOTING FLOW CHARTS(continued)

2.2 No characters display

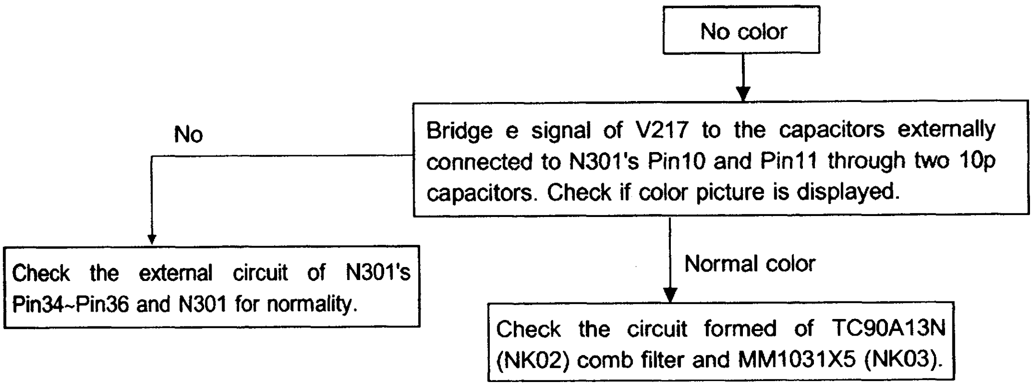

No characters display
Measure horizontal pulse of N001's Pin21 for 4.6Vpp (normal value).
Abnormal
Check V002, C071, R091, R040 and R039.
Normal
Measure pulse of N001's Pin20 for 4Vpp (normal value).
Normal
Check and replace C008, C009 and N001.
Abnormal
Check V001, C040, R075, R090 and R041.

2.3 Channel number remains unchanged during auto program.


Channel number remains unchanged during auto program.
Yes
Check and re-place OM8839PS.
Check if normal picture is display ed or not during auto program.
Check if normal noise dots are displayed during auto program.
No
Check the circuit from Pin6 to Pin13 of TDA8839 and TDA8839 for normality.
Yes
Check the tuner and pre-IF amplifier.

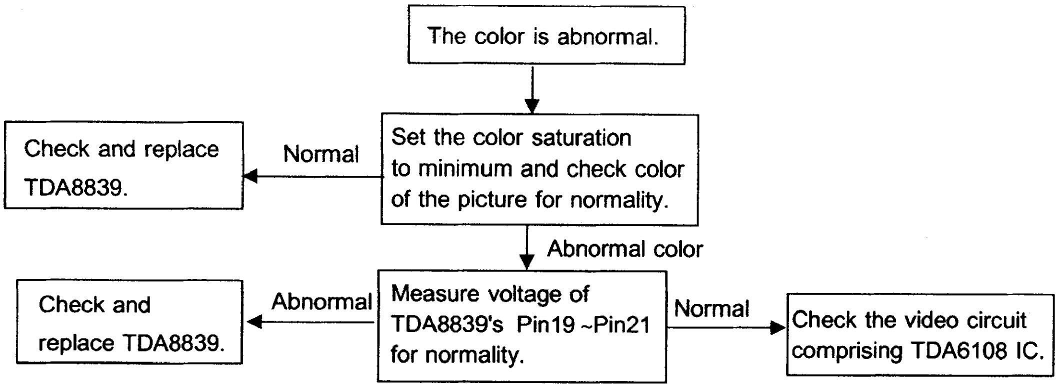
3. Video Signal Processor

3.1 No color


No color
Bridge e signal of V217 to the capacitors externally connected to N301's Pin10 and Pin11 through two 10p capacitors. Check if color picture is displayed.
No
Check the external circuit of N301's Pin34~Pin36 and N301 for normality.
Normal color
Check the circuit formed of TC90A13N (NK02) comb filter and MM1031X5 (NK03).

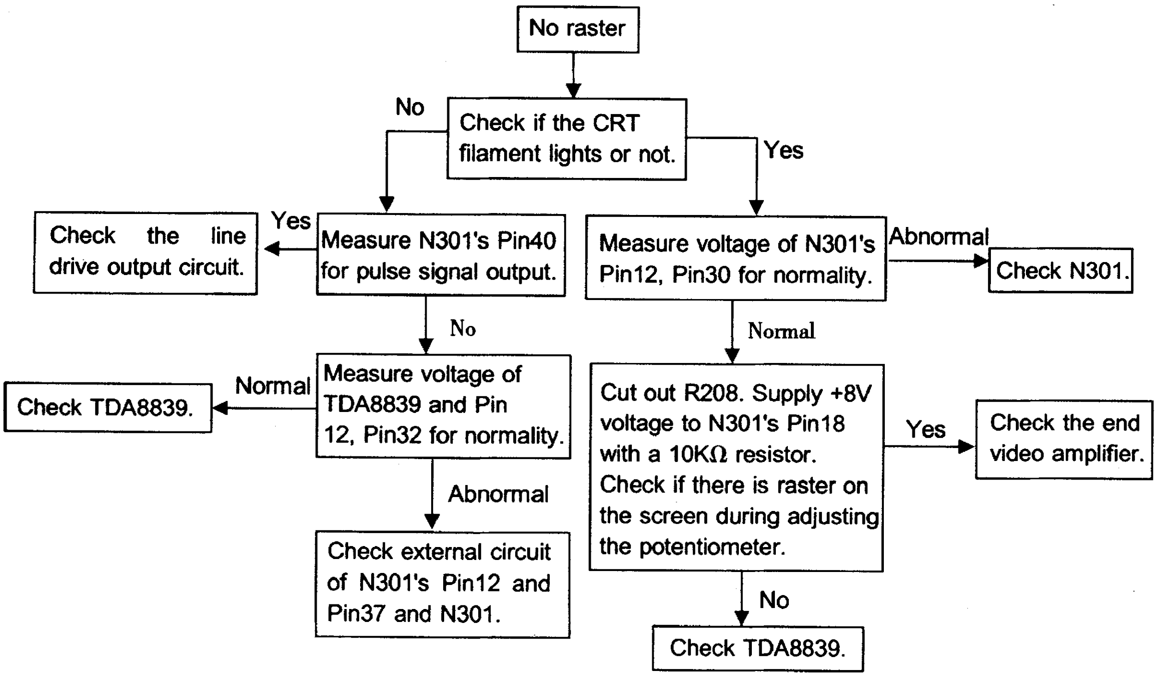
TROUBLESHOOTING FLOW CHARTS(continued)

a. The color is abnormal.


The color is abnormal.
Set the color saturation to minimum and check color of the picture for normality.
Normal
Check and replace TDA8839.
Abnormal color
Measure voltage of TDA8839's Pin19 ~Pin21 for normality.
Abnormal
Check and replace TDA8839.
Normal
Check the video circuit comprising TDA6108 IC.

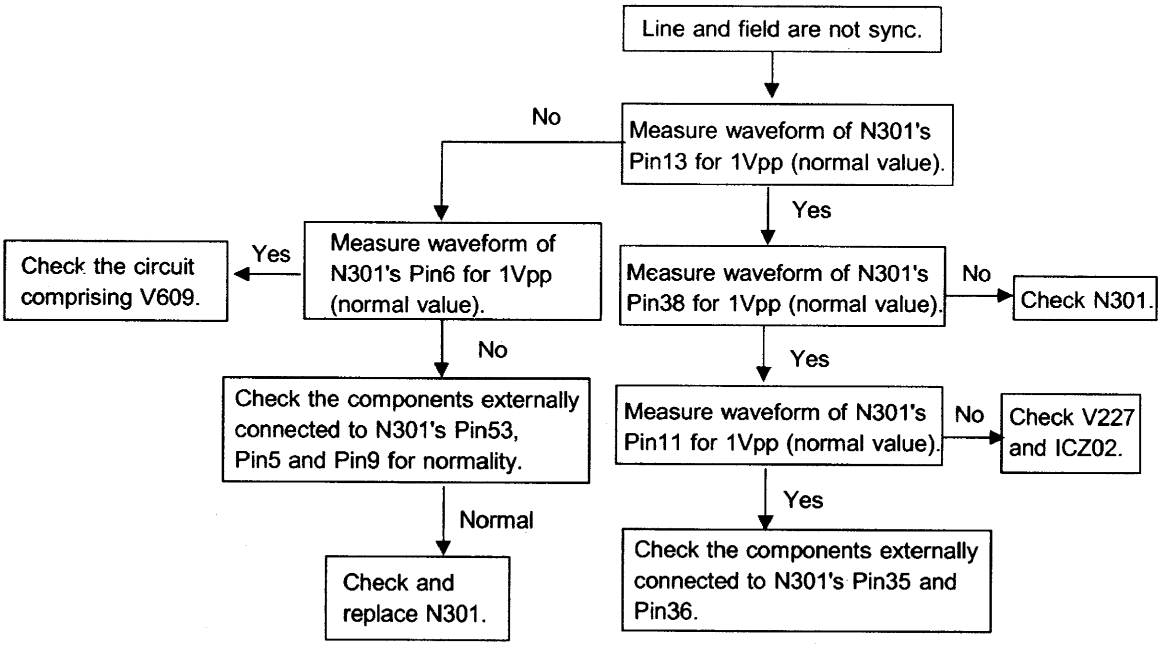
4. Horizontal/Vertical Scan Circuit

4.1 No raster

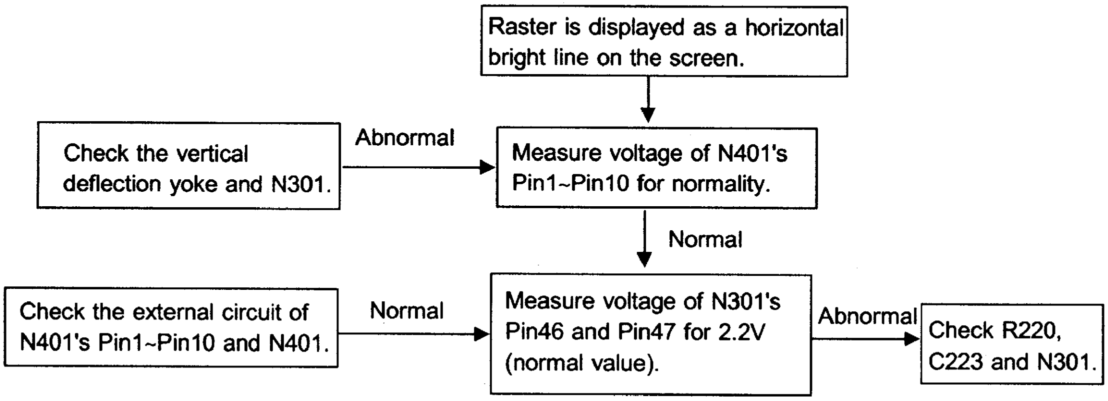

No raster
Check if the CRT filament lights or not.
No
Yes
Measure N301's Pin40 for pulse signal output.
Yes
Check the line drive output circuit.
No
Measure voltage of TDA8839 and Pin 12, Pin32 for normality.
Normal
Check TDA8839.
Abnormal
Check external circuit of N301's Pin12 and Pin37 and N301.
Measure voltage of N301's Pin12, Pin30 for normality.
Abnormal
Check N301.
Normal
Cut out R208. Supply +8V voltage to N301's Pin18 with a 10KΩ resistor. Check if there is raster on the screen during adjusting the potentiometer.
Yes
Check the end video amplifier.
No
Check TDA8839.

TROUBLESHOOTING FLOW CHARTS(continued)

4.2 Line and field are not sync.

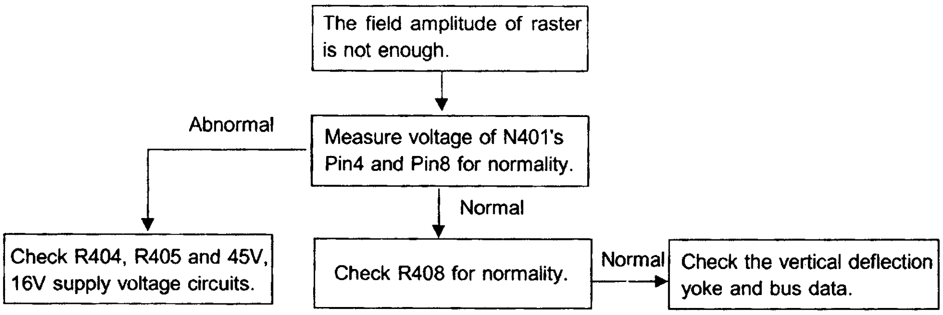

Line and field are not sync.
Measure waveform of N301's Pin13 for 1Vpp (normal value).
No
Measure waveform of N301's Pin6 for 1Vpp (normal value).
Yes
Check the circuit comprising V609.
No
Check the components externally connected to N301's Pin53, Pin5 and Pin9 for normality.
Normal
Check and replace N301.
Yes
Measure waveform of N301's Pin38 for 1Vpp (normal value).
No
Check N301.
Yes
Measure waveform of N301's Pin11 for 1Vpp (normal value).
No
Check V227 and ICZ02.
Yes
Check the components externally connected to N301's Pin35 and Pin36.

4.3 Raster is displayed as a horizontal bright line on the screen.

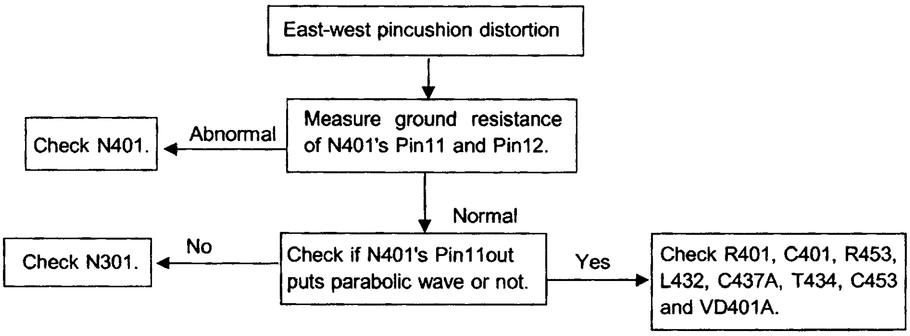

Raster is displayed as a horizontal bright line on the screen.
Measure voltage of N401's Pin1~Pin10 for normality.
Abnormal
Check the vertical deflection yoke and N301.
Normal
Measure voltage of N301's Pin46 and Pin47 for 2.2V (normal value).
Abnormal
Check R220, C223 and N301.
Normal
Check the external circuit of N401's Pin1~Pin10 and N401.

TROUBLESHOOTING FLOW CHARTS(continued)

4.4 The field amplitude of raster is not enough.

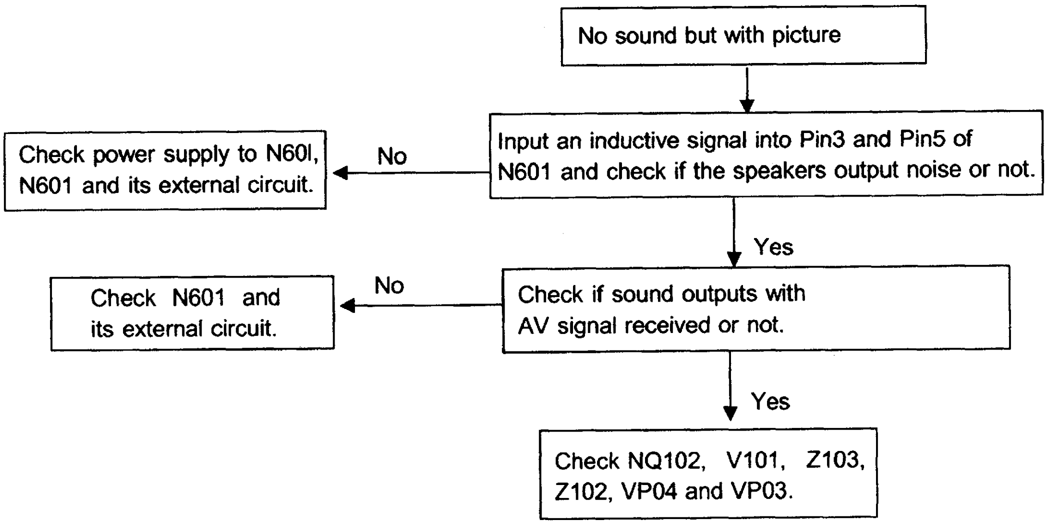

The field amplitude of raster is not enough.
Measure voltage of N401's Pin4 and Pin8 for normality.
Abnormal
Check R404, R405 and 45V, 16V supply voltage circuits.
Normal
Check R408 for normality.
Normal
Check the vertical deflection yoke and bus data.

4.5 East-west pincushion distortion


East-west pincushion distortion
Measure ground resistance of N401's Pin11 and Pin12.
Abnormal
Check N401.
Normal
Check if N401's Pin11out puts parabolic wave or not.
No
Check N301.
Yes
Check R401, C401, R453, L432, C437A, T434, C453 and VD401A.

5. Audio System

5.1 No sound

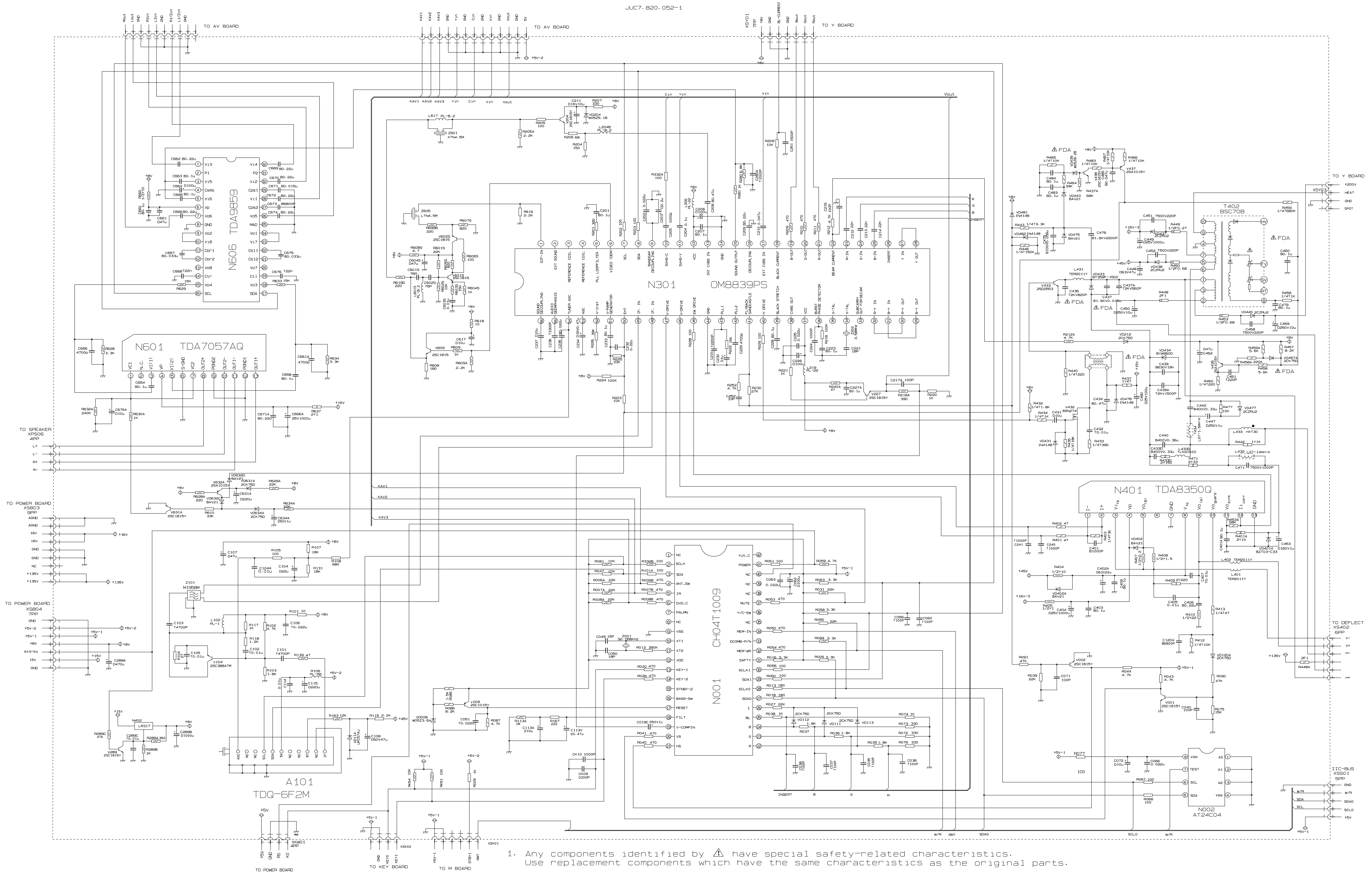

No sound but with picture
Input an inductive signal into Pin3 and Pin5 of N601 and check if the speakers output noise or not.
No
Check power supply to N60I, N601 and its external circuit.
Yes
Check if sound outputs with AV signal received or not.
No
Check N601 and its external circuit.
Yes
Check NQ102, V101, Z103, Z102, VP04 and VP03.

SERVICE SPARE PARTS LIST

APPENDIX:

1. CIRCUIT DIAGRAM
2. FINAL WIRING DIAGRAM
3. FINAL ASSEMBLY DIAGRAM
4. PRINTED CIRCUIT BOARD DIAGRAMS

APPENDIX 1: CIRCUIT DIAGRAM OF AT3208S (1)



1. Any components identified by ⚠ have special safety-related characteristics.
Use replacement components which have the same characteristics as the original parts.

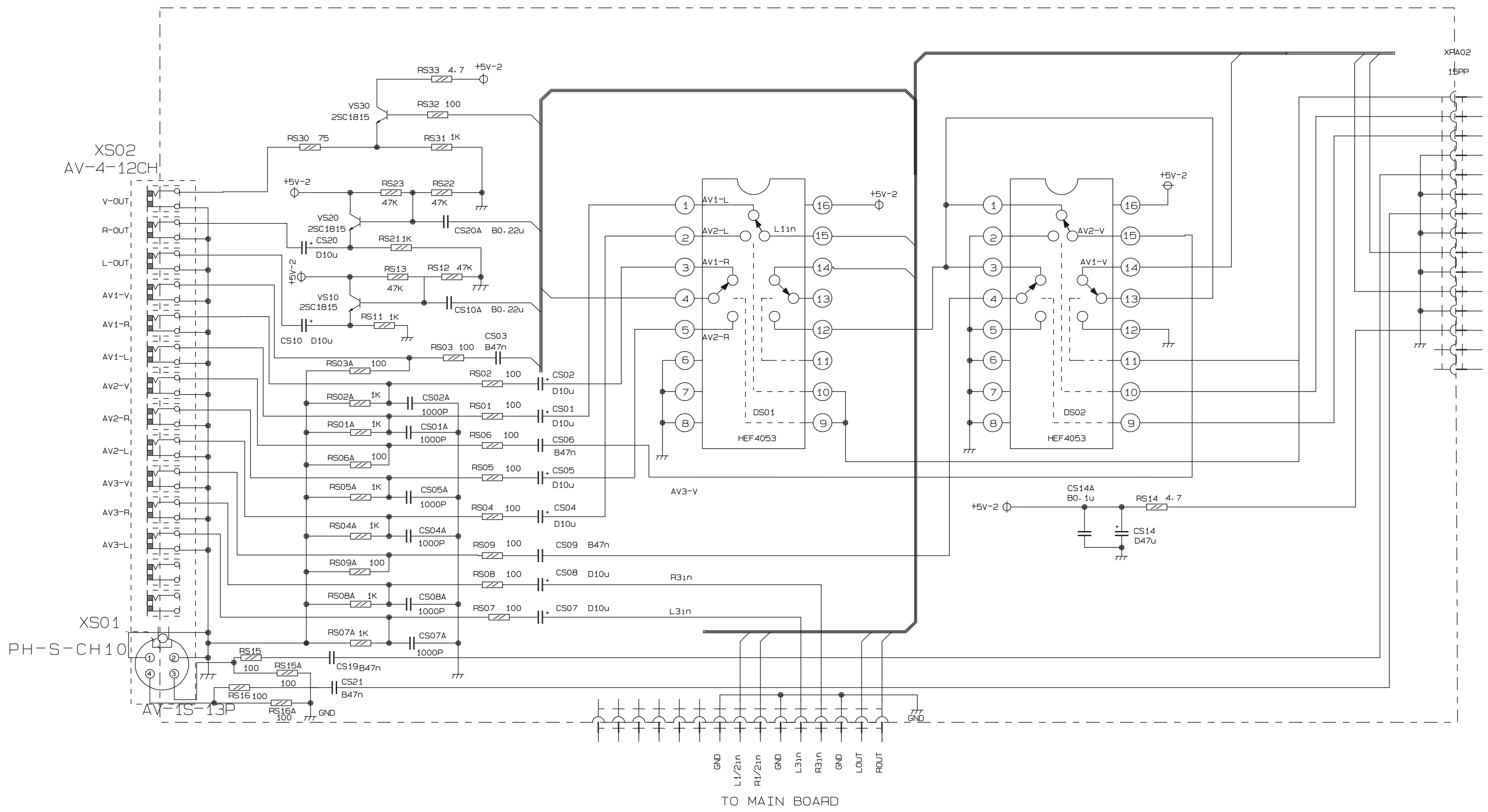
2. ⏚ Cold ground ⊥ Hot ground

3. ⚠ FDA This symbol tells you that replacement components related to high voltage beam current and X_ray radiation should not be made at will.

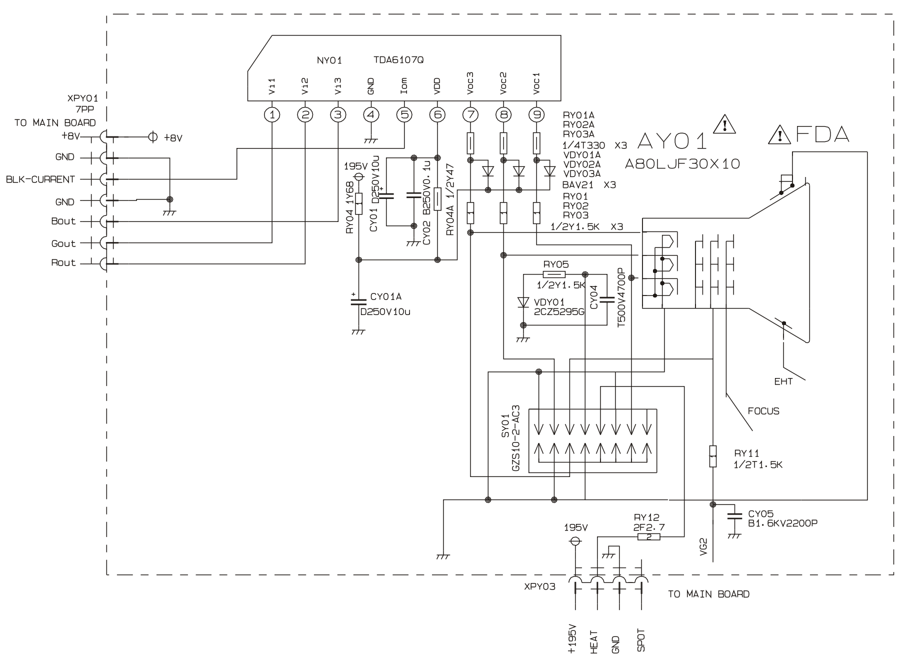
This circuit diagram is only for reference.
Specifications are subject to change without notice.

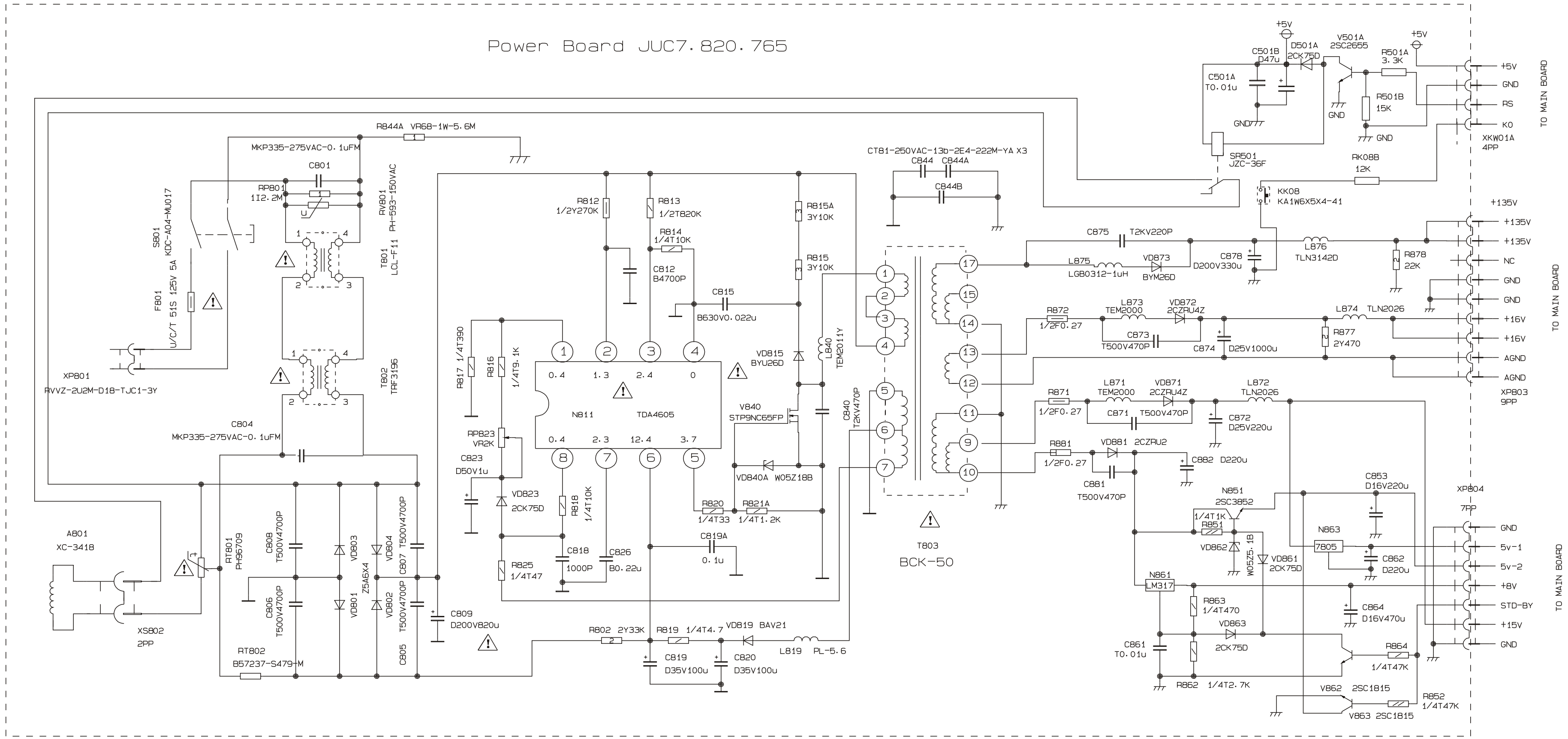
APPENDIX 1: CIRCUIT DIAGRAM OF AT3208S (2)

AV Board JUC7.820.426-1

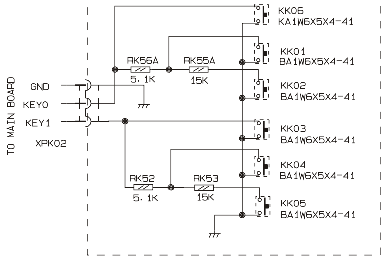


Y Board JUC7.820.392

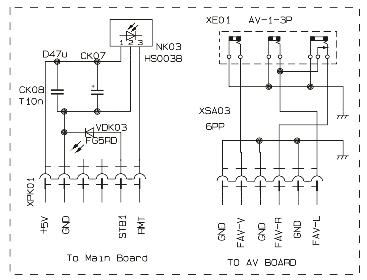




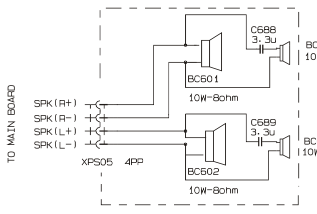
K Board JUC7.820.012



M Board JUC7.820.013



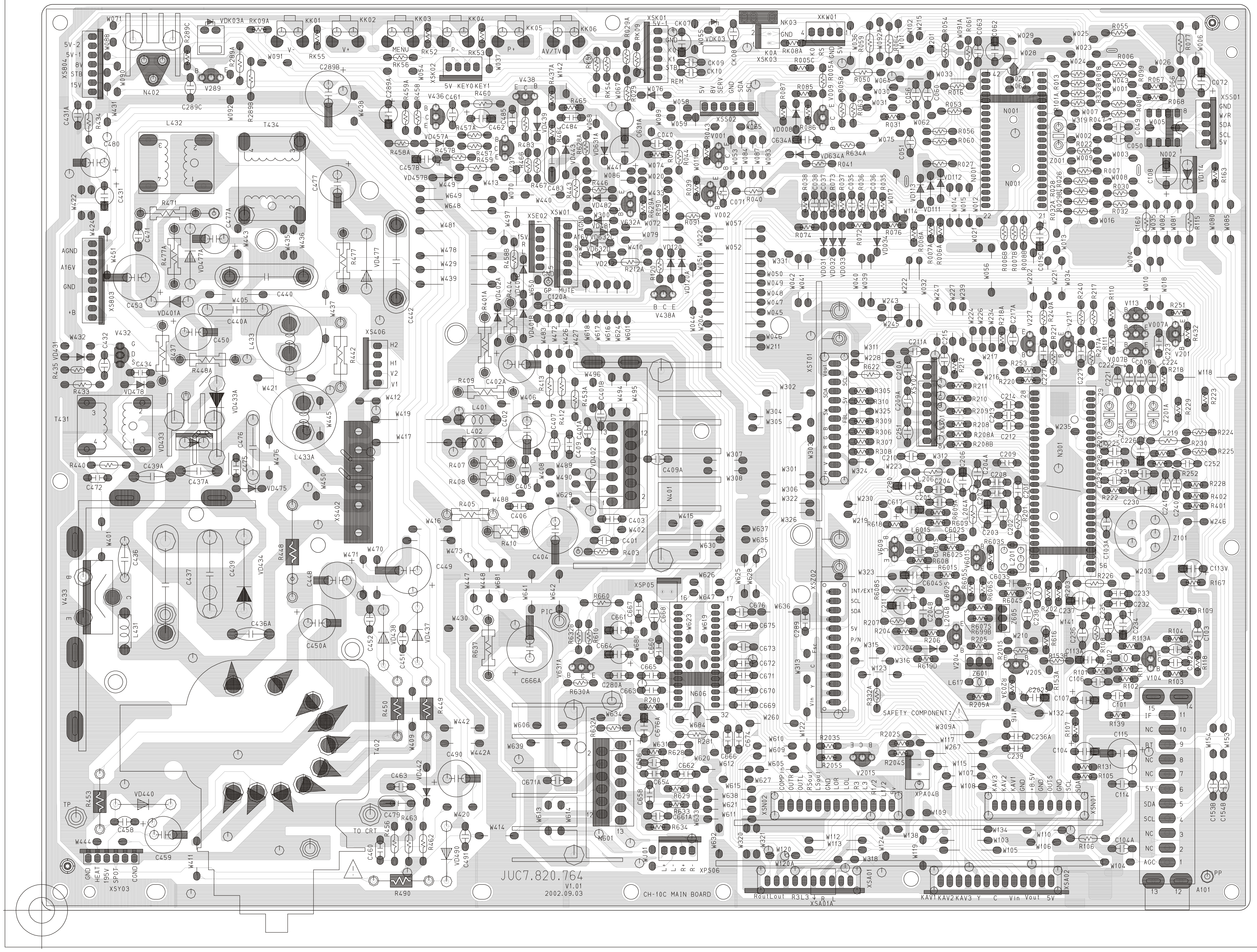
Speaker



1. Any components identified by ⚠ have special safety-related characteristics. Use replacement components which have the same characteristics as the original parts.
2. ⏚ Cold ground ⊥ Hot ground
3. ⚠ FDA This symbol tells you that replacement components related to high voltage, beam current and X-ray radiation should not be made at will.

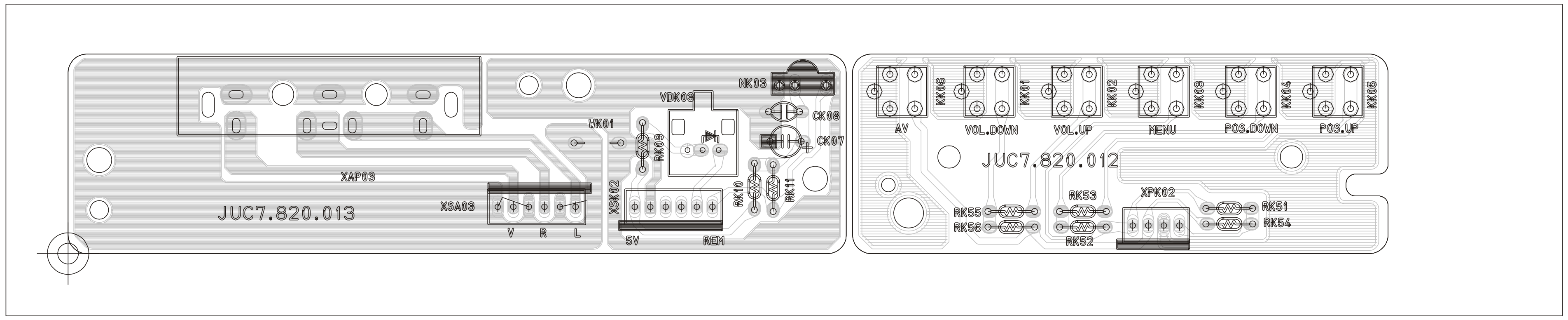
This circuit diagram is only for reference. Specifications are subject to change without notice.

APPENDIX 2: MAIN PCB OF AT3208S

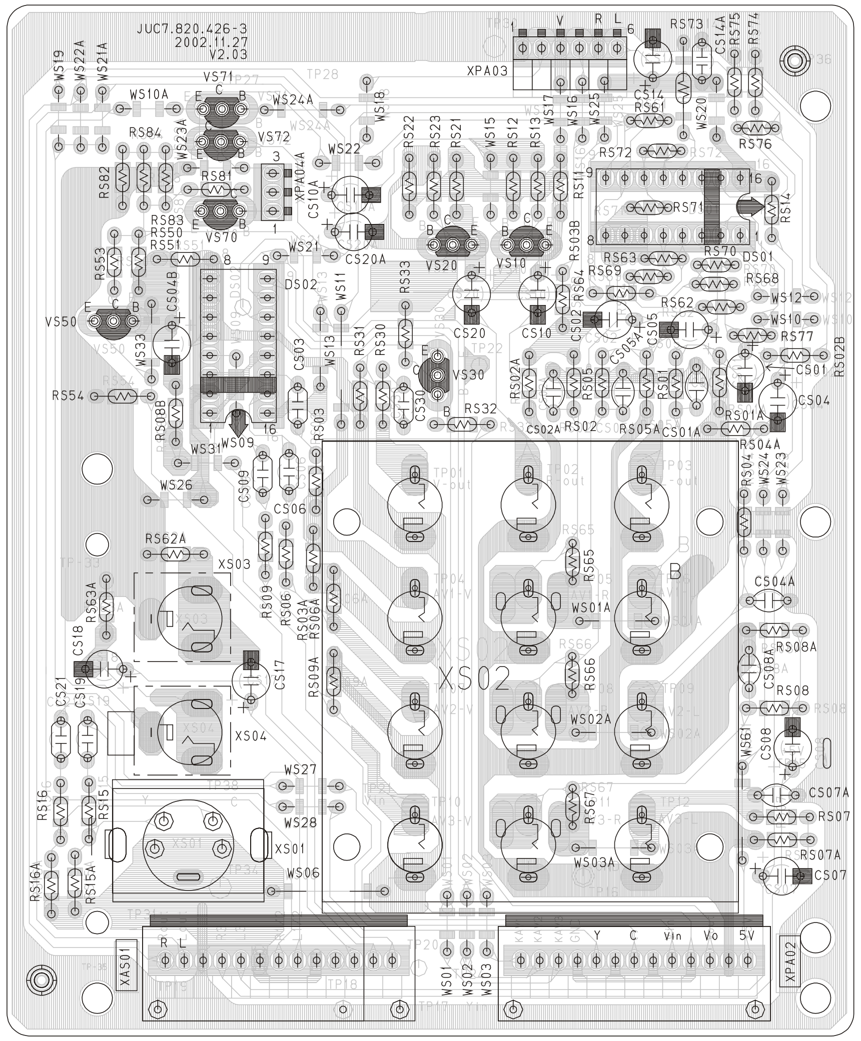


APPENDIX 2: PCB OF AT3208S

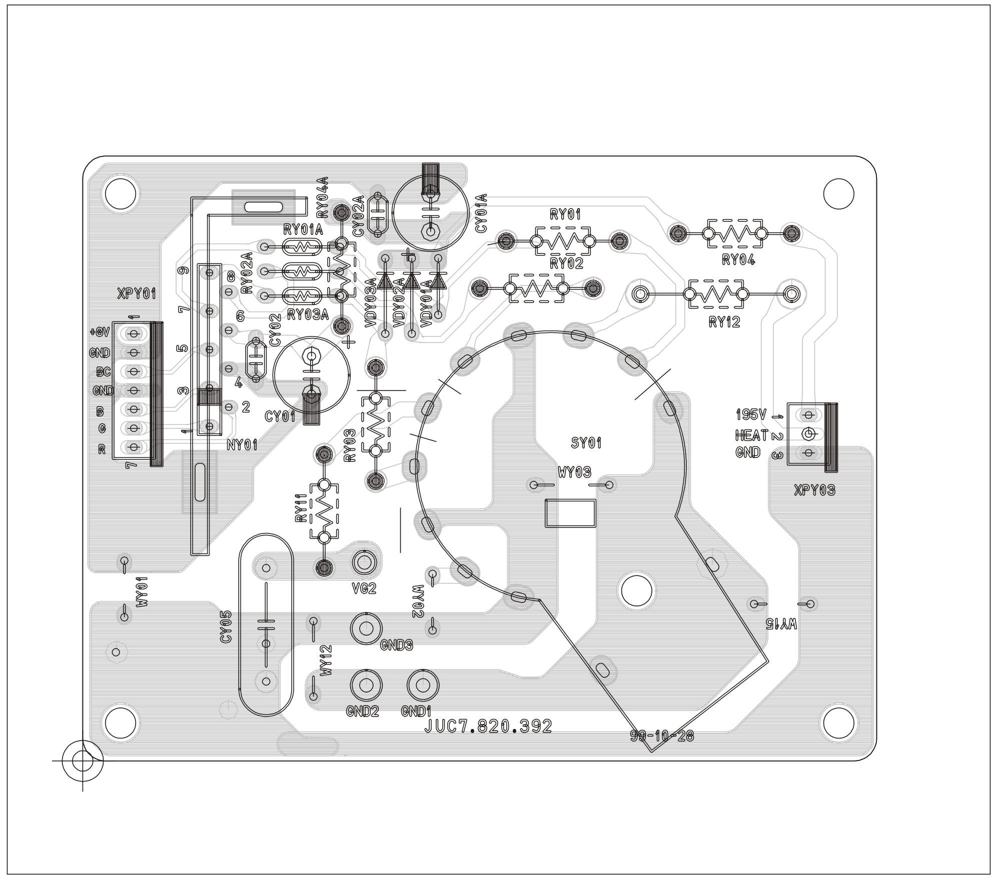
CONTROL PCB



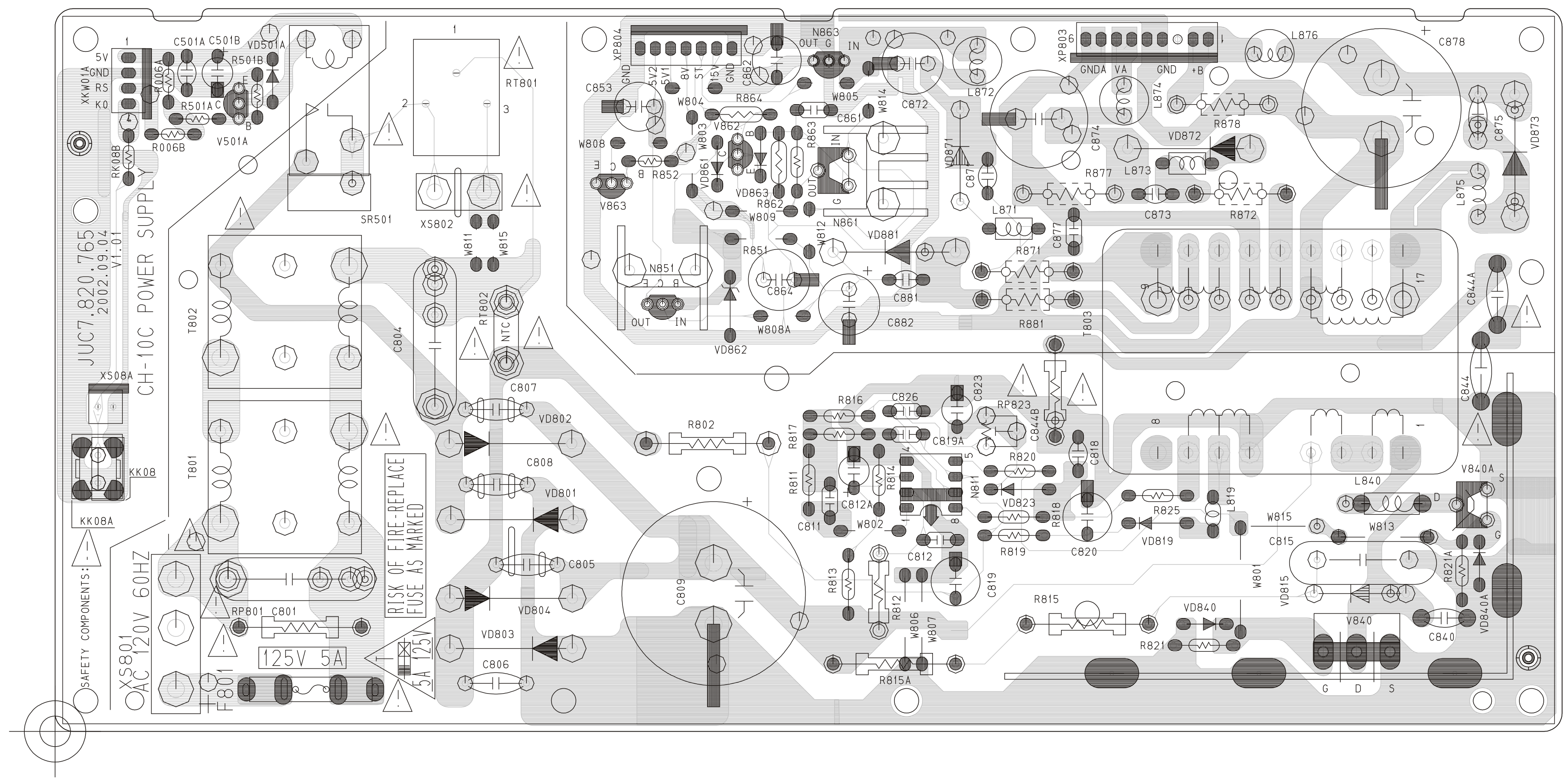
AV PCB



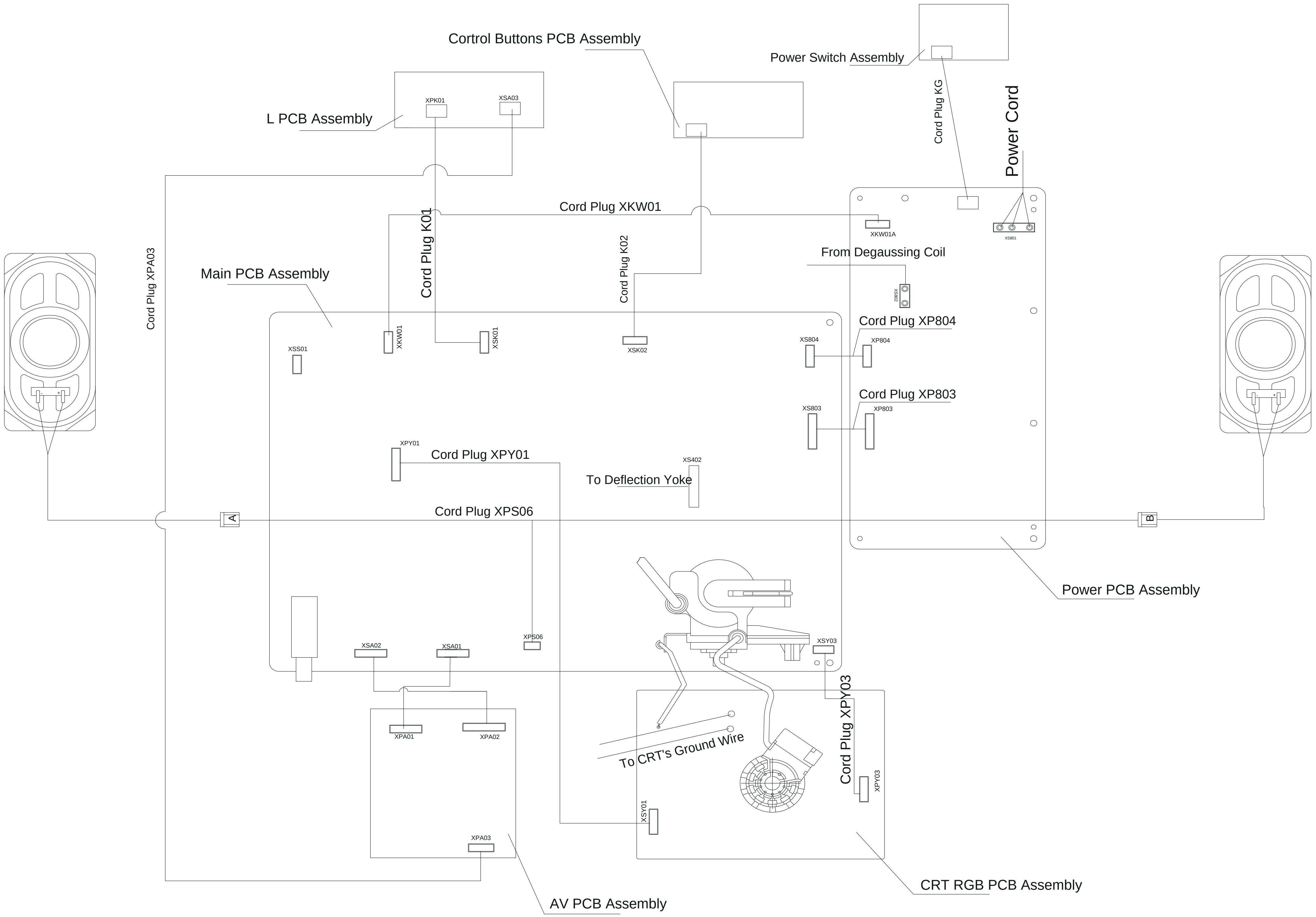
CRT RGB PCB



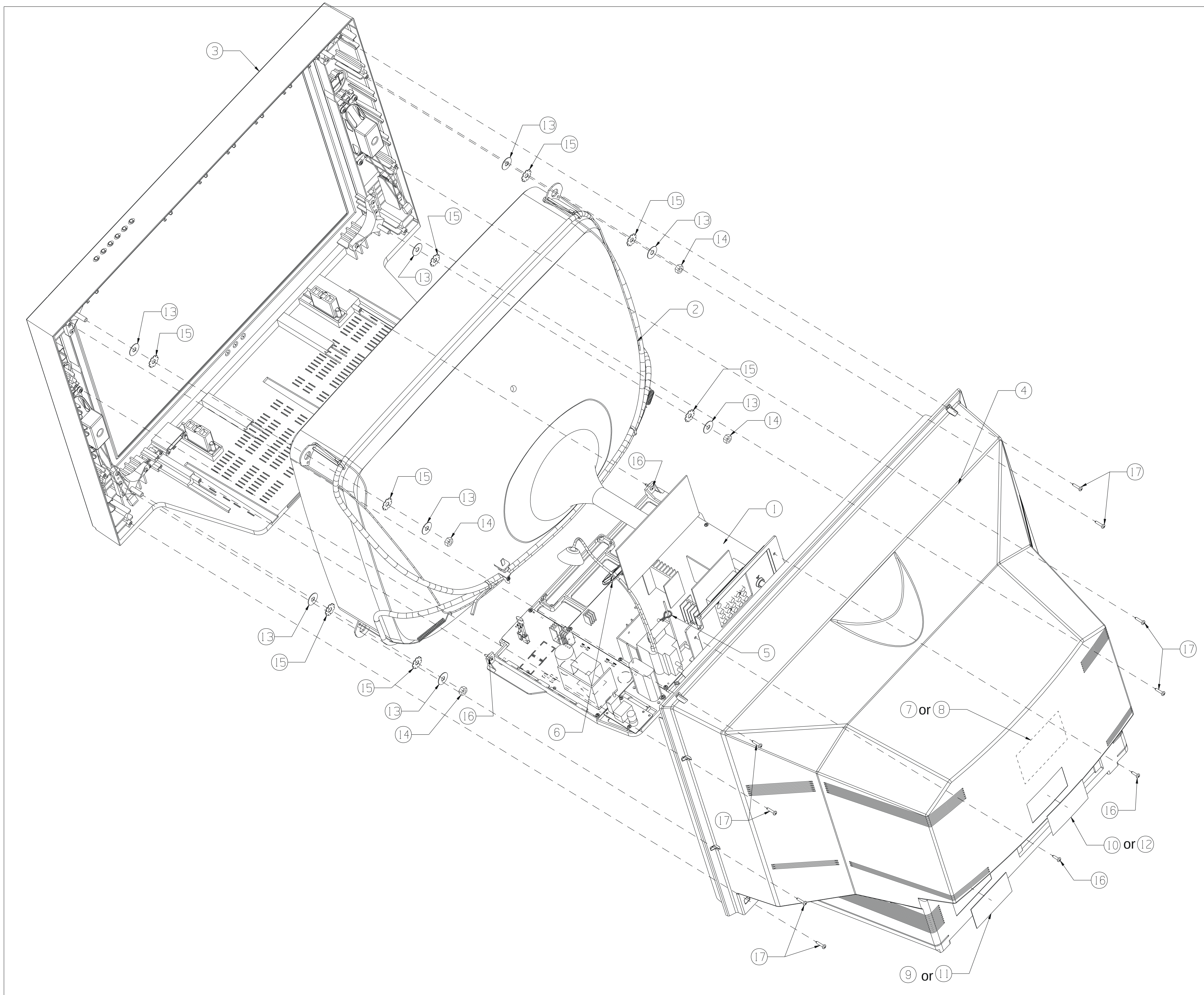
APPENDIX 2: POWER PCB OF AT3208S



APPENDIX 3: FINAL WIRING DIAGRAM OF AT3208



APPENDIX 4 ：*FINAL ASSEMBLY OF At3208*



20	Soldering agent	
19	Tin solder	
18	Q04-3 white nitro magnetic paint	
17	Tapping screw 4X25VwAHCh	8
16	Tapping screw 4X16BTHCh	4
15	C-1 notched washer	8
14	I hexagon nut A and B M6	4
13	Washer	8
12	C-UL label	1
11	Real label	1
10	C-UL label	1
9	Real label	1
8	Admonition label	1
7	Admonition label	1
6	Distance clip	1
5	Wire clip	2
4	Back cover assembly	1
3	Front cover assembly	1
2	CRT assembly	1
1	Chassis assembly	1
Serial No.	Parts	Quantity

APEX DIGITAL TELEVISION In-Warranty Schedule by Model

Product Model No.	LIMITED WARRANTY [1]				Carry-In Service	In Home	Stock Repair	REIMBURSEMENT RATES				
	Parts	Remote Control	Labor	CRT [3]	Yes/No	Yes/No	Yes/No	Carry-In		Home Service		Stock
								Minor	Major	Minor	Major	Repair
13 inch [2]												
AT1302	90	90	90	90	N	N	N	N/A	N/A	N/A	N/A	N/A
AT1308	90	90	90	90	N	N	N	N/A	N/A	N/A	N/A	N/A
20 inch [2]												
AT2002 / AT2002S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
AT2008 / AT2008S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
GT2011J	365	90	90		N	N	N	N/A	N/A	N/A	N/A	N/A
GT2011S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
GT2015	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
GT2015DV	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
KT2006	1 YEAR STORE REPLACEMENT											
24 inch [2&3]												
AT2402	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
AT2408 / AT2408S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
GT2411S	365	90	90	365								
GT2415	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
PF2425	365	90	90	730	N	N	N	N/A	N/A	N/A	N/A	N/A
KT2406	365	90	90	365	Y	N	N	[4]	[4]	[4]	[4]	[4]
25 inch [2]												
AT2502	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
AT2502S	365	90	90	365	N	N	N	N/A	N/A	N/A	N/A	N/A
27 inch [3]												
AT2702	365	90	90	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
AT2702S	365	90	90	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
AT2708 / AT2708S	365	90	90	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
GT2711S	365	90	90	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
GT2715	365	90	90	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
PF2725	365	90	90	730	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
GT2715DV	365	90	90	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
32 inch [3]												
AT3208S	365	90	90	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
GT3215	365	90	90	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
PF3225	365	90	90	730	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
KT3226	365	90	90	730	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
PROJECTION												
GB4308	365	90	365	730	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
GB43HD09	365	90	365	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
GB5108	365	90	365	730	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
GB51HD09	365	90	365	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
GB55HD09W	365	90	365	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]
GB65HD09W	365	90	365	365	Y	Y	Y	[4]	[4]	[4]	[4]	[4]

[1] Limited Warranty is printed on the last page of the owner's manual

2 All defective units 13" - 25 "during the first 90 days of ownership will be exchanged at the original place of purchase. Dealer may contact APEX to receive a Return Authorization from Apex for credit or exchange.

3 Should the picture tube fail during the In-Warranty period the product will be exchanged. The customer is responsible for the Service Center diagnostic fee after the initial labor warranty period and for all packing, transportation and insurance charges.

4 See Master Dealer File for Rates for each Dealer

NOTE: All handling, packing, shipping or freight charges are the responsibility of the customer.